SCIENTIFIC AMERICAN

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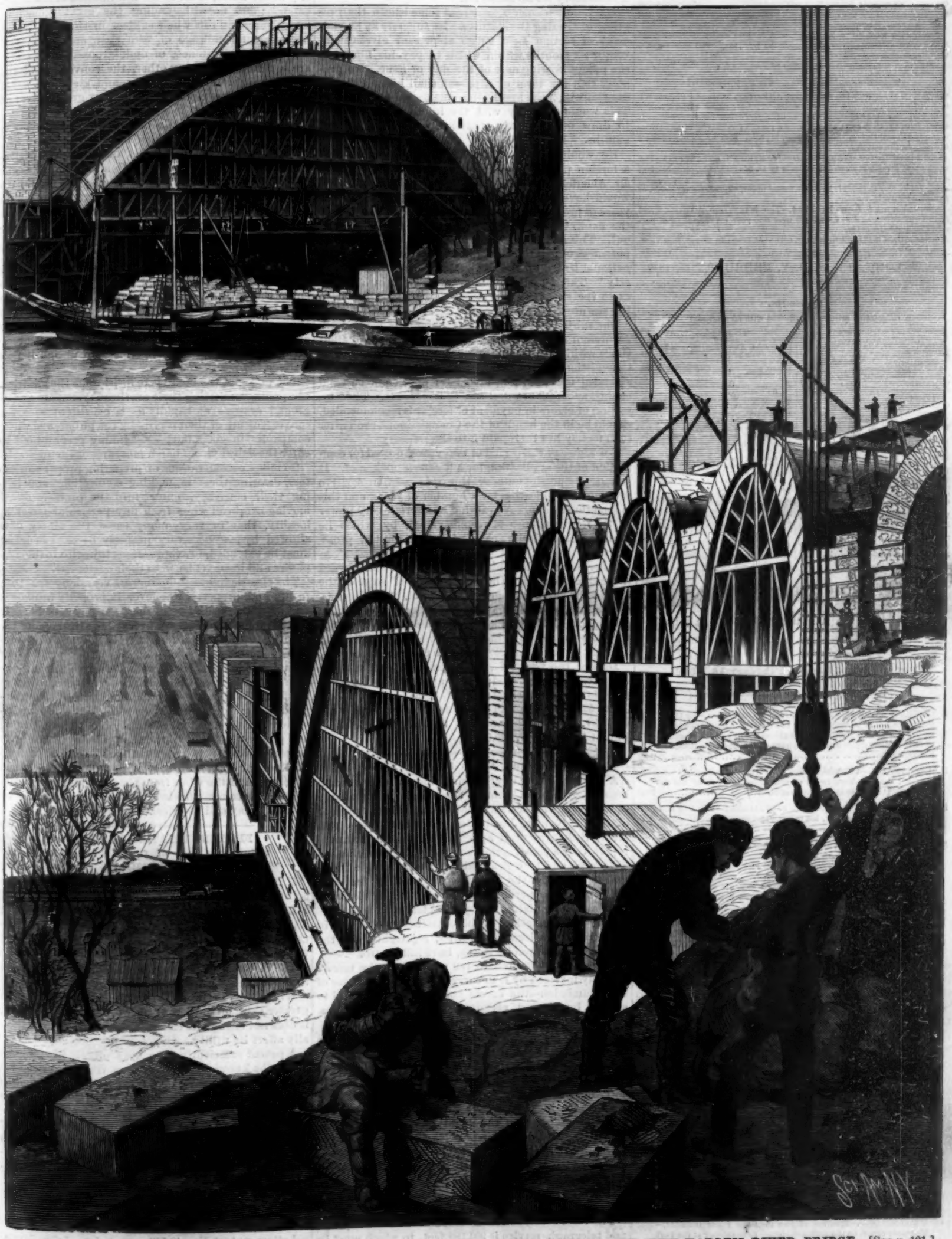

FALSE WORK UNDER EAST ARCH.—GENERAL VIEW OF OPERATIONS IN PROGRESS ON THE NEW HARLEM RIVER BRIDGE.—[See p. 101.]

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NEW YORK, SATURDAY, FEBRUARY 18, 1888.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 668,

For the Week Ending February 18, 1888.

Price 10 cents. For sale by all newsdealers.

THE ANNUAL REPORT OF THE COMMISSIONER OF PATENTS.

The annual report of the Hon. Benton J. Hall, Commissioner of Patents, to the Senate and House of Representatives, dated January 31, 1887, has been published. It appears in the *Official Gazette* of Feb. 7, 1888. The report is rather longer than usual, and bears the mark of much careful work and thought. It begins by a statement of the need of additional room for the working force of the Patent Office. Additional employes, the Commissioner states, are not required; with the increased facilities that more space would give, the present force could satisfactorily perform the work. A laboratory is also asked for.

The Commissioner considers at some length the propriety of altering the statutes. He suggests an amendment of section 4,885, which at present gives the inventor six months within which to pay his final fee, the patent bearing date of the day of issue. He proposes that the term of a patent shall begin with the date on which the application was passed and allowed. This would do away with the inducement presented to draw out the term, practically speaking, for six months.

He would also have statute 4,887 amended so that a foreign patent would be without influence upon an American patent to the same inventor. He would have an American patent grant the seventeen years of protection to the patentee without regard to the expiration of any foreign patent he might take out. This statute also interferes with any advantage patentees of inventions might obtain from the "International Union for the Protection of Industrial Property." The Commissioner is very decided in his views as to the expediency of expunging this section from the statute books, or of modifying it materially.

The subject of assignments of patents is considered. At present such instruments must be filed in the Patent Office within three months of the date thereof. The Commissioner recommends that the statute should be amended so that filing at a later date shall be valid against subsequent purchases or mortgages. The correction of errors in payment of fees, it is recommended, should be in the hands of the Commissioner, even after such money has been paid into the treasury.

The abuse of the period of two years allowed for completion of the application for a patent is spoken of. It is perfectly possible under this rule (section 4,894) to prolong an application for a number of years, and this is sometimes done. A granting of discretionary power to the Commissioner is recommended, by which he shall be able to declare cases closed for want of prosecution.

Other points of less interest are treated, and toward the end of the report the "destruction of some of the coils of the patent system" is spoken of. The Commissioner supports the patent system as productive of great good, admitting that it would seem entirely proper for the government to have the power of extinguishing a patent by paying a proper sum to the owners thereof.

During the year 1887, 21,378 patents for inventions and designs were issued; 34,420 applications for such patents were received. The total receipts were $1,144,509.60; excess of receipts over expenditures, $150,037.38; total balance in treasury to credit of Patent Office, $3,257,490.91.

Underground Wires in New York.

A law for placing electric wires under the streets and removing the poles is now in operation. It is in charge of the Board of Electrical Control, consisting at present of Mayor Hewitt, Jacob Hess, Theodore Moss, and Henry S. Kearney. It appears from their first annual report that a construction company (the Consolidated Telegraph and Electrical Subway Company) is authorized to construct the subways designed by the commission, and to permit the use of them by electrical companies upon fair and impartial terms.

Over the excavations of this construction company in the streets, the local authorities, represented by the commissioner of public works, have full control.

Its profits are limited to ten per cent on the money actually invested by it in carrying out the directions of the commission—the excess going to the city; and to all its books and accounts the local authorities, represented by the comptroller, have access.

A provision of law makes it incumbent upon the board to give to companies operating conductors overhead ninety (90) days of notice for the removal of their overhead wires after a sufficient construction of subways has been made ready in any street or locality—reference being had to the general direction of the wires in use; and in the event of the companies so notified not removing their poles and wires from the street before the expiration of the ninety days of notice, it is provided that the local authorities shall thereupon remove them.

The total length of trench excavated for the laying of subways since July, 1887, is 189,918 feet.

The total construction of single duct for telephone and telegraph service is 903,180 feet, to which must be added 4,050 feet for distributing service and connections to central stations.

Estimating 80 wires per single duct, the total capacity for telegraph and telephone service is 72,254,400 feet or about 13,700 miles of wire.

The total construction of single duct conduit for arc lighting and power service is 254,250 feet, and the capacity of this conduit may be estimated as sufficient for 2,542,500 feet, or nearly 500 miles of wire.

In addition to the above, the number of feet of conduit for incandescent lighting is 186,745, containing 560,235 feet of conductors.

The capacity of conduit provided in the city of New York during the existence of the Board of Electrical Control is considerably greater than there is in any city in the world, so far as the information of the board extends; and notwithstanding the great difficulties which surround this whole subject in this city, which has a greater mileage of wire than any other, and where the circumstances of underground construction are as difficult as in any other, the conversion of the present overhead to an underground system is a fact about to be accomplished, to a very great extent at least, in the near future.

Already the Western Union Telegraph Company is occupying the conduits which have been constructed, with some five hundred miles of wire. The Metropolitan Telephone & Telegraph Company has some one thousand miles of wire in the subways; and the Edison Illuminating Company, whose conductors were laid in the trench at the time of construction, has, as has already been said, more than one hundred miles underground.

The Metropolitan Telephone & Telegraph Company, the Western Union Telegraph Company, the Brush Electric Light Company, and others, are preparing to enter the subways at many points, and should the efforts of the board be seconded by energetic action on the part of the local authorities when the ninety days of notice has expired, many of the streets must necessarily be freed from the dangerous and unsightly pole systems.

The policy of the board is to insist upon the electrical companies converting their overhead systems to underground systems as rapidly as is consistent with the convenient use of their service by the public, and where companies in good faith are making preparations to enter the subways, no harsh measures seem desirable.

So many considerations of preparing proper conductors, drawing them in, making connections, and testing their efficiency, enter into the problem of removing overhead wires from any particular street or locality, that in very many cases the ninety days allowed by law may very properly be extended, and must be extended, to avoid serious injustice to the companies and inconvenience to their customers.

The electric light conductors are very dangerous both to life and property whenever improperly insulated; and improper insulation of these dangerous and deadly wires is to be found almost everywhere throughout the city. The only regulations affecting the use of electrical conductors in the city of New York prior to the organization of this board were a few resolutions of the board of aldermen which have never been, so far as this board is able to ascertain, at all regarded or complied with; and the provisions of the fire underwriters in reference to the insulation of the arc lighting and power wires, which, though probably sufficient to protect property if strictly adhered to, are of little avail, owing to the absence of proper inspection and supervision of the wires from time to time, as their insulation becomes affected by the elements and by natural decay and deterioration.

DECISIONS RELATING TO PATENTS.

Supreme Court of the United States.

LAWTHER *vs.* HAMILTON *et al.*

Mr. Justice Bradley delivered the opinion of the court.

Letters patent No. 168,164, granted to Alfred B. Lawther, September 28, 1875, for improvements in processes for treating oleaginous seeds, declared valid and to have been infringed.

The omission of one step of an old process with an improved result constitutes a new process.

Where the new process requires greater care, or even greater skill, on the part of the workmen than formerly, it does not change its character as a process or materially affect its utility.

A patent sufficiently describes a process when by the aid of the knowledge derived from the state of the art the same may be carried out from the description in the patent by those skilled in the particular manufacture.

A claim for a process consisting of several steps may be limited by the state of the art and the description in the patent to the instrumentalities or their equivalents as thus described, which are essential in the carrying out of the process claimed.

Supreme Court of the United States.

DREYFUS *et al. vs.* SEARLE.

Letters patent No. 48,728, granted to John Searle, July 11, 1865, for a process for imparting age to wines, declared invalid for lack of patentable invention.

The application of artificial heat to ripen wine being old, and the application of artificial heat to the outside of casks to ripen wine contained therein being old, it did not require invention to apply artificial heat to the inside of the casks to ripen the wine in the same.

There was no invention in applying steam pipes to the interior of a cask for the purpose of heating the wine contained therein, steam pipes having been previously applied to the interior of a closed tub for the purpose of heating water in the same.

MILITARY NOTES.

Eiserne Portionen (rations of iron) is the name given by the *Militar Wochenblatt* to the canned provisions which the German soldier is now compelled to carry in his knapsack or haversack, not for immediate consumption, but for use at those times when his command is removed from the base of supplies or the quartermaster's department is short. It says: "These victuals of iron are, during war, to be used on the evening preceding a great battle, or, better, when, the army making a sudden change of front, the convoys are for a day or two retarded." Much of this canned provision is put up in America, and is said to be both better and cheaper than the German. The 7th corps (Westphalian) commanders have recently experimented with canned chocolate and cocoa, which, though seemingly light refection for a marching column, has, on the contrary, been found excellently adapted.

The report made to the French Chirurgical Society by the surgeons who examined the bodies of the soldiers killed by the explosion of *melinite* at Belfort shows, as printed in *L'Avenir Militaire*, that the effects of this new explosive are even more to be dreaded than was supposed. Of the 17 men hit, only six lived. The bodies of the slain, it is said, were literally torn into shreds, and it is the belief of Dr. Tachard and his assistants that much of the substance exploded only after entering the bodies, or, in other words, that melinite as now compounded explodes at different periods, some early, some late; the first bursting the shell into fragments, and the latter, adhering to these fragments, exploding when driven home. They remarked on the absence of burns and of poisoning. The bodies of the wounded were found to be tattooed as if with explosive dust.

The French military authorities have recently issued stringent orders regarding the observance of the Sabbath day, and an over-zealous officer, Colonel Pons, commanding the 3d Infantry of Marine, who insisted upon calling out his men for practice on Sunday, has been sent to the penal colony—New Caledonia.

That grand old ship the Victory, Nelson's flagship off Cape Trafalgar, when he encountered and beat the combined French and Spanish fleet, October 21, 1805, was recently found to be in a sinking condition, but, happily, has been saved, and now, after weathering the storms of a century, rides at anchor in Portsmouth harbor. A plate fastened to her quarter deck marks the spot where the great admiral, shot through the body by a musket ball, survived only long enough to see the enemy strike his colors.

The *Revue Militaire de l'Etranger* says the Russians are constructing sledges at Stanislau for the transportation of field artillery through the snow. It says, as quoted by the *Broad Arrow:*

"A stout log of timber, destined to support the axletree, is placed in the longitudinal axis of the sledge and stoutly secured. The gun carriage is run trail first over the sledge, the width of which, being less than the track of the wheels of the gun, renders this possible. The under surface of the axletree being made to rest on the log above mentioned, the wheels are removed and placed over the trail. Provision is made for the security from injury of the elevating gear. The axletree arms and trail are now secured by lashings, as also the wheels. The whole rides with sufficient stability, and the axletree seats, if any, may be occupied by two gunners. The limber is similarly disposed on a second sledge, except that no log is here necessary to support the axletrees. The pole (or shafts) may be lashed between the 'sabots' of the sledge. Three gunners may be seated on the limber boxes."

Compare this complicated apparatus with the simple plan adopted by Bonaparte when, in his first Italian campaign, he dragged his cannon over Alpine snows, set in grooves roughly hewn out of the trees which the soldiery felled, the wheels set, pair by pair, astride of mules and horses. Field guns, it is true, are larger now than they were then, but knowing as we do, from subsequent tests, how great was the ingenuity of the great master of war, there can be little doubt he would have suggested to himself a ready means of handling heavier material of like kind. Ready wit is worth a deal of preparation!

The Italian expeditionary army, encamped in the fortified town of Massowah, Abyssinia, and now awaiting the attack of King John, are said to be under fine discipline, notwithstanding the ravages of the fever. The Italian foot soldier bears fatigue poorly, if he is correctly reported, though the corps called Bersagliers, recruited from the Italian Alps and Apennines, is hardy and enduring. At Dogali, where a previous Italian expeditionary force were slaughtered almost to a man, the Abyssinians captured many stands of arms of the repeating type, with a store of ammunition pertaining to the same, and it is said a portion of the enemy's force are armed with these rifles. King John's lieutenants, Negus and Ras Alula, and most of their men, are of Coptic, that is to say Christian, extraction. They are big men, hardy, courageous, and intelligent, and since only one of the many armies sent against them in recent years succeeded—it was that under Lord Napier of Magdala—they are by no means to be regarded as a despicable foe. Lord Napier carried the war, without delay, into the very heart of their country, and thus gave them no time for preparation, and the terrible fever no chance to spread among his troops. The Italians, on the contrary, have been playing a waiting, and what old African soldiers regard as a dangerous, game, and there is authority for the report that they have tired of this, and will soon re-embark for Naples, as the rainy season is about to set in.

The Austrians are busily strengthening the fortifications of Pola, which has become the headquarters of the Austro-Hugarian navy. Pola is at the extremity of the Istrian peninsula, which protrudes 60 miles into the head of the Adriatic and flanks the approaches to the two principal commercial harbors of the empire, Trieste and Fiume, and commanding what may become the hostile port of Venice. Austria is looking to acquire a port in the Ægean Sea. Her navy consists of 11 ironclads, 2 unarmored cruisers, 5 corvettes, 39 torpedo boats, 8 river monitors—the same being manned by 9,000 men.

Government Telegraphy.

Nearly all the discoveries and improvements in telegraphic science have been American. The specially American demand for the improvements stimulated the most ingenious and ambitious operators in our telegraph companies to discover newer and better methods. There were many rival lines of telegraph, and competition between them was fruitful in efforts to acquire greater control over electricity, and get out of it faster and cheaper work. To all these inventors Senator Edmunds stands in his place in the United States Senate and gives notice: "If my postal telegraph bill becomes law, the Secretary of War will have power to seize your devices and machines, and use them in the government service; and if you and he cannot agree upon a price for them, your only remedy will be to sue the government in the Court of Claims, with the privilege, if dissatisfied with its award, of appealing to the Supreme Court." Whatever influence this language, perfected into law, may have on other things, it will end telegraphic invention. That is dead sure. Research and endeavor in this most delicate and elusive department of science will no longer have the encouragement of large reward and a competitive market. The admirable business of these finely organized men, who lead lives of ingenious experiment and patient trial, will be struck with paralysis in face of the brigand purpose of the government to seize their devices, and to drive them to the cost and heart-breaking of law suits.

And what will become of our business of commercial and social telegraphy, thus stolen from private ownership and corporate management? It is now the best in the world. Why? Its owners are Americans, driven to unceasing endeavor in their business by unceasing competition. Its managers are Americans, who cannot be matched for administrative ability and technical knowledge. Its operators are Americans, exceptionally intelligent and skillful. Indeed, the Western Union Telegraph is the most distinctive American institution in the United States. But within a year after the government should get hold of it, it would be impossible to recognize it, so wholly would it have lost every characteristic excellence. For government telegraphy will be a flat failure. It will be a failure: First, for want of the stimulus of private ownership spurred by competition; secondly, because the most skillful, brightest, and manliest of the operators will not accept public service, there being no future in it, and a government clerkship being to them a descent in life; thirdly, because these skilled specialists would scorn to be officered by politicians who have no knowledge of the business of which they are justly proud; fourthly, principally for the reason that the skilled men who, as superintendents of divisions, now manage the business and plans of the great telegraph lines, could not be drawn into the public service.

Federal office holding is the business of second rate and third rate men; of men who drop their muskets in the battle of life and straggle to the rear; of men willing to exchange large possibilities for small certainties. The corporate telegraph managers, on the other hand, are first rate men and high priced. When they leave the wires, as they are constantly tempted to do in every direction, they go upward in responsibility, rank, and pay, and never go downward. Mr. Hughitt, the president of the Chicago and Northwestern Railroad Company, confessedly the best railroad man in America, started on his upward career as a telegraph operator under the great Tom Scott, with but a common school education. His schooling on the wires, in and out of a railroad station and on its platform, was worth a dozen university educations. Fifty thousand dollars a year would not draw this great administrator into the management of a government telegraph, either as Postmaster-General or Superintendent.

Among the great steel rail makers and iron masters of the world are the Brothers Carnegie, of Pittsburg. Each in unaided youth was a telegraph operator on the Pennsylvania Railroad. Each left the wires for higher service and larger pay in railroad management. Both went as part purchasers and managers into a Bessemer steel mill on the line of the road. Sheer volume and quality of brain, inspired by a genius for organization and command, and directed by courage and morality, carried them to the summit of industrial success. A column of this paper would not suffice for the mention of the promoted operators, officers of the Western Union Telegraph Company, of kin in quality to the Carnegies and Hughitt, who have been captured from the wires by great railroads, banking institutions, and manufacturing corporations, and carried off to superintendency on high pay. It is officers like these who have given success to American telegraphy. Politics attract not these men. To them public employment is a tomb for the young and an asylum for the aged. In the case of the chief of them, to whom the government would naturally turn for management of a telegraph plant to include over 53,000 post offices, we do not believe that the Presidential salary would tempt Gen. Eckert to think of undertaking it.

Bad enough will be the case of the government's postal telegraph without adequate general and division officers to manage it, capable and ambitious men, trained in every department of their business. It has been truthfully said that, excepting a woman's spring bonnet, nothing quicker gets out of usefulness than a telegraph line not constantly looked after.

In corporate telegraph service the operators live and work under discipline. The conditions of employment are fidelity, industry, and obedience to rules. For want of these virtues operators lose their places. Transmute these men, by act of Congress, into federal office holder, straightway they pass out from the discipline of a well managed corporation, and take life easy in the short hour, go-as-you-please ways of a government department.

We warn the people of the United States that if they permit the system of telegraphy they now enjoy to be carried off into the Post Office Department, government telegraphy will as surely be a failure in America as it has been in Europe.—*N. Y. Sun.*

Cities of Half a Million and Over.

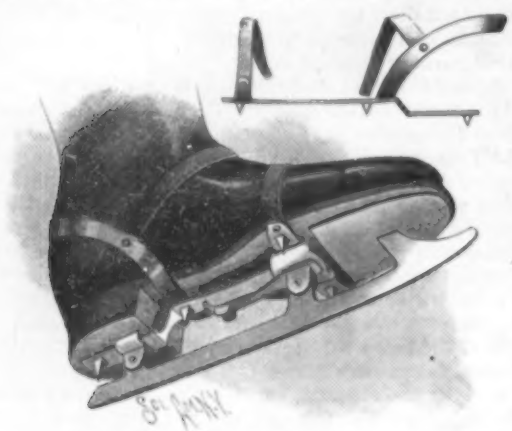
London, England	3,955,819
Paris, France	2,269,023
Canton, China	1,500,000
New York, N. Y.	1,400,000
Aitchi, Japan	1,332,050
Berlin, Prussia	1,122,330
Changchoofoo, China	1,000,000
Sian, China	1,000,000
Tschautchau-fu, China	1,000,000
Tokio, Japan	987,887
Sartama, Japan	902,717
Tien-tsin, China	950,000
Philadelphia, Pa	850,000
Hang-tcheon, China	800,000
Pekin, China	800,000
Techingtu-fu, China	800,000
Woo-chang, China	800,000
Brooklyn, N. Y.	771,000
St. Petersburg, Russia	766,664
Calcutta, India	766,298
Vienna, Austria	730,105
Chicago, Ill	715,000
Constantinople, Turkey	700,000
Foo-choo, China	630,000
Moscow, Russia	611,974
Hang-chow-foo, China	600,000
Hankow, China	600,000
Liverpool, England	573,000
Glasgow, Scotland	514,043
Pekalonga, Java	505,204
Madrid, Spain	500,900
Bangkok, Siam	500,000
King-te-chiang, China	500,000
St. Louis, Mo	500,000
Tat-seen-loy, China	500,000

An Automatic Electric Chess Recorder.

Dr. Wurstenberger, of Zurich, Switzerland, has constructed an electrical machine that records the movement of chess men on the usual board. It is now at work in London. The record is printed on a paper strip, like the stock printing machine. A print is made when a chessman is taken up or removed from the board; also when set down on the board. It is a very complicated machine.

A CONVERTIBLE ICE CREEPER AND SKATE.

A combined ice creeper and skate, adapted for attachment to boots, shoes, or rubbers, and in which the skate may be applied to the foot without removing the creeper, has been patented by Mr. Richard C. Abbott, of East Blue Hill, Me., and is illustrated herewith. The creeper has a sole-bearing strip or plate, with lateral extensions having upward projections, each provided with buckles and eyes for attachment of the creeper to the shoe, etc. The sole-bearing plate has a downward offset for the better rest of the treading face of the heel, spurs being placed upon the lower surface



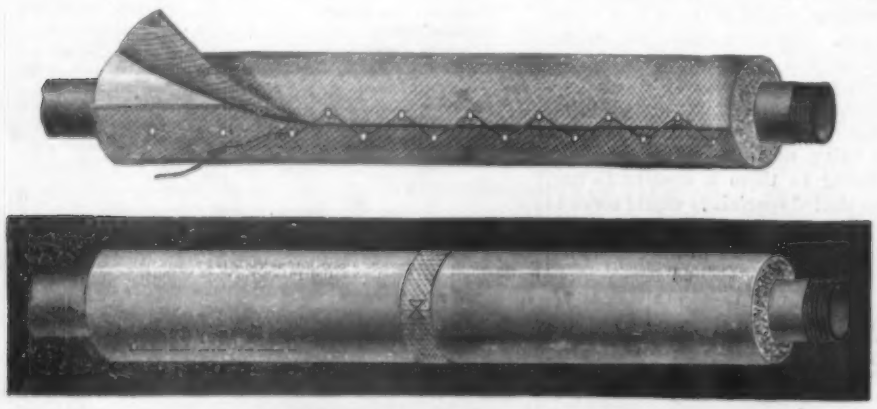
ABBOTT'S CONVERTIBLE ICE CREEPER AND SKATE.

of the creeper as desired. The skate blade is adapted to be engaged with the creeper by being provided with horizontal lateral extensions, having ear pieces arranged to lie under and against the extensions of the creeper. A spring plate on the skate blade is also adapted for engagement with the creeper, making a firm attachment, the whole constituting a device calculated to be particularly advantageous to ice harvesters and others.

NON-CONDUCTING PIPE COVERINGS.

The Chalmers-Spence Company, of New York, has for many years been engaged in the manufacture of asbestos packings, sheathings, and other fireproof goods, their standard non-conducting coverings for steam and hot air pipes and for boilers, etc., being pretty well known. The illustrations herewith represent a new Patent Removable Covering made by the company, styled class "C," made by a special and improved process of manufacture. It is formed entirely of pure asbestos fiber, in cylindrical sections of three feet length, of the exact size of the pipe to be covered. The asbestos fibers are so interlaced that the sections are both strong and flexible, affording so large a number of air cells as to give this covering the very highest non-conducting quality, while it cannot char or be in any way injured if exposed to the most intense heat from without or within. The Fire Felt Sectional Covering for boilers and large surfaces made by the company is identical in construction with the class "C" covering, but is made in sheets, in convenient form to be readily applied. In connection with these coverings, the company also supply a Superator Jacket, which is both fire and water proof. It is made of a flexible sheet of asbestos, strengthened by wire netting, the asbestos being waterproofed by a special process. This jacket is provided with patent lacings, by which the covering can be easily and most effectively secured in place and readily removed when required without any cutting or loss of material. These Coverings and the Superator Jacket have been subjected to the most thorough tests by United States navy engineers, and receive their warm commendation. One of the illustrations represents the application of this Superator Jacket. A cheaper substitute is afforded by the canvas jacket, which may be sewed or pasted on.

PIPE COVERING.



PURE ASBESTOS REMOVABLE PIPE COVERING.

The company also manufacture a full line of asbestos goods. Their general office and factory is at 8th Street and the East River, New York City, with branches in all the principal cities of the country.

The Influence of Moderate Drinking on Health.

Under the title of "The Influence of 'nipping' upon Health," Dr. Harley, the English hepatologist and nephrologist, discusses, in the January number of the *Provincial Medical Journal*, the injurious effects of drinking alcoholic beverages "in moderation." He says that the majority of men are moderate drinkers, and, as a consequence, most of one's patients belong to this class. Dr. Harley is right in stating that the effects of alcohol taken in excess are universally known to physicians. But his other statement, that very little has been written on the consequences of drinking in moderation, can only be accepted in the qualified sense of "comparatively little." Be this as it may, the figures published by him, as taken from the registrar-general's report, are certainly rather staggering. Comparing the mortality tables of men exposed to the temptation of frequent "nipping" with those of men not similarly exposed, the result is "startling in the extreme, more particularly as regards the proportion of liver diseases." For it would appear that the rate of mortality is six times greater among those whose business is practically inseparable from "nipping," than among those representing all the other industries combined.

It appears further that, after the liver, the kidneys, the heart, and the nervous system become most frequently affected in moderate imbibers. Dr. Harley says that "it is not difficult to understand why the liver, of all organs in the body, should be the most affected by 'nipping,' when it is remembered that almost every drop of alcohol taken into the stomach is absorbed by the branches of the portal veins, is conveyed directly to the liver, and has to filter through its tissues ere it can get into the general circulation, and by it become distributed to the other organs of the body." He also showed, so long ago as 1853, that the mere injection of alcohol into the portal vein in dogs is sufficient to disorder the hepatic functions to such an extent as to cause the animals to become diabetic in the short space of from two to three hours.

That the kidneys suffer less than the liver is probably due to the fact that less alcohol reaches them than the former. Nevertheless, alcohol is, in part, eliminated through those emunctories, and Harley claims to have obtained "pure alcohol" from the kidneys of persons who have died intoxicated, by the simple process of distillation.

According to the author, "the only tangible reasons, however, that we as yet possess for alcohol disordering the renal function exist (1) in the fact of its elimination causing extra work, and (2) that alcohol increases the renal circulation, just as it increases the circulation elsewhere, and no doubt at the same time causes a corresponding increase in the diameter of the renal blood vessels by engorgement, and consequent pressure on the inter-vascular tissues."

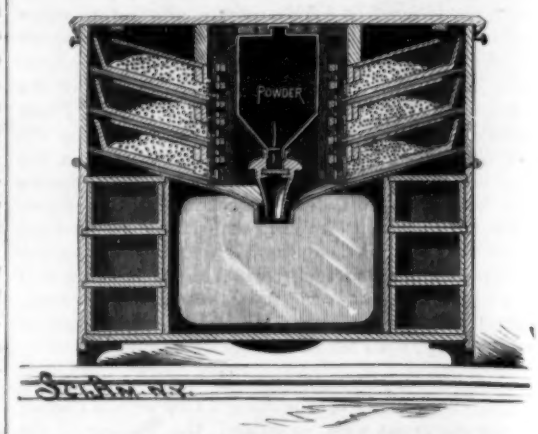
As regards the bad effect of "nipping" upon the heart, it consists in inviting disease in the predisposed, as well as in augmenting disease which already exists.

Finally, with regard to the nervous system, Dr. Harley believes that alcohol taken in small quantities at a time, but frequently repeated, acts deleteriously by keeping the blood vessels on the stretch, by engorging them, and causing them to press upon the nerve cells and fibrils. This interferes both with the proper performance of their functions and with nutrition.

The nerves also suffer indirectly through the action of alcohol on the blood. For Harley has found that, even in the small proportion of five per cent, alcohol "exerts a powerful chemical effect on blood, so powerful as to entirely derange one of its most important functions—namely, the function of respiration. The alcohol seems to act like an asphyxiant, inasmuch as it not alone diminishes the power of the red corpuscles to absorb oxygen, but to exhale carbonic acid, and that, too, in the same way (though to a somewhat less extent) as morphia does. This peculiar chemical action of the alcohol on the blood nerve pabulum may be thought to give a reasonable explanation of the paralyzing action of alcohol upon the nervous system, seeing that oxidation is the motor power of all vital action, and in direct proportion to its activity are the manifestations of life accelerated or retarded. Every breath we draw, every movement we perform, every thought we think, is but the outcome of the transformation of matter under the influence of oxygen. If, then, it be true, as above shown, that alcohol possesses the power of preventing the constituents of the blood from being properly oxidized, and thereby fitted for the purposes of nutrition, it is easy to account for its producing a chain of neurotic symptoms terminating in coma and death."—*Medical Record.*

AN IMPROVED AMMUNITION CASE.

A case particularly designed to set on counters by storekeepers and others, for keeping powder, shot, and



SECTION SHOWING INTERIOR ARRANGEMENT.

FREMAUX'S AMMUNITION CASE.

gun materials for retailing, has been patented by Mr. Edward C. Fremaux, of Mermenton, La., and is illustrated herewith. The space allowed for the scales in the case is open at the side next the storekeeper, but at its opposite side is closed by a glass plate, that the customer may see the weighing operation, while there will be no danger from sparks of cigars, etc. The central powder receptacle has a hinged top, to give ready access thereto for refilling or removing, and in its lower hopper-shaped portion is a valve, operated by a spring pull knob in the front of the case, allowing the passage of powder through a spout to the scoop of the weighing scales. A finger agitator is so connected with the valve as to be vibrated by the pulling of the knob, thus preventing the caking or choking up of the powder at the valve outlet. The inclined shot trays at the sides have discharging apertures, the opening of which is effected by spring pull rods, whereby shot may be delivered from each compartment of the tray, through the central hopper or chute to the weighing scales. The construction is such as to give ample strength for the shot trays and drawers for holding various gun supplies, as caps, primers, cartridges, etc., while affording convenient access to each compartment.

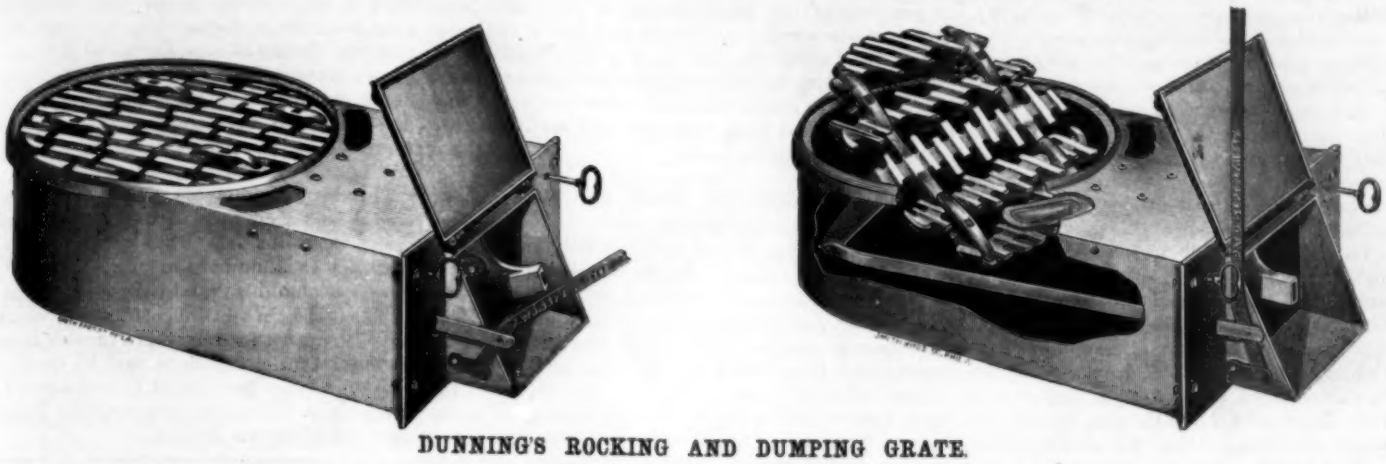
Improvement of Forests.

Senator Hale lately introduced a bill prepared by the American Forestry Congress to preserve the forests, which is outlined as follows: "It withdraws from entry as forest lands all public lands of the United States more valuable for their timber than for agricultural purposes. It institutes the office of commissioner of forests, and authorizes the appointment of four assistant commissioners. The commissioner is instructed to form the forest land into what are designated as forest reserves. He is given power to frame rules and regulations for the government of these reserves, and to appoint rangers to see that the rules are observed. No forest lands are to be sold, but the stumpage on them may be disposed of in the discretion of the commissioner of forests." The New York *Times* urges the replanting of land denuded of merchantable timber, and believes that by a wise arrangement the state might derive a large revenue from its mature timber and the thinning of the new plantings, and realize an annual sum equal to that for which some of the lands have been sold.

AN IMPROVED ROCKING AND DUMPING GRATE.

A recently patented grate, especially suitable for steam-heating boilers, and easily adjustable to an anti-dust base on which the boiler rests, is represented in the accompanying illustrations, one view showing the grate in its normal fire-holding position and the other its position in dumping the fire. This grate, as will be seen, removes the ashes from every part of the fire pot evenly, for which purpose the grate is rocked by the lever while the operator is standing up, clinkers being dropped into the bars and readily broken as the lever is worked, so that they are carried into the ash pit below. It will be noticed also that this grate does not require the use of the ring heretofore necessary for suspending the grate bars, thus preventing the accumulation of ashes at this point.

With the anti-dust base the grate can be shaken without making any outside dust or dirt whatever. It is simple in construction, and should one of the parts give out, it can be readily replaced by any one. These grates are manufactured by William B. Dunning, of Geneva, N. Y., and are used in all the well known patent steam-heating boilers made at his establishment.



DUNNING'S ROCKING AND DUMPING GRATE.

Colored Mortar for Brickwork.

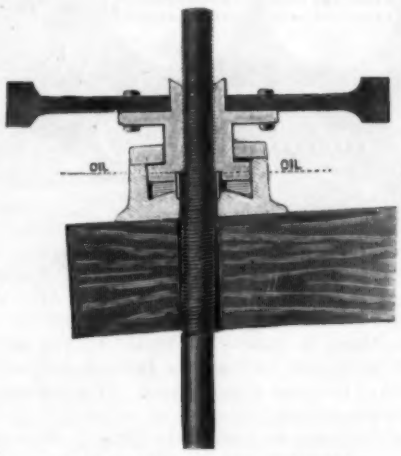
The *Real Estate Review and Record* (Brooklyn) says that common bricks of almost any district may be so sorted as to produce contrast in tint or "tone"—red, and yellow or "cream color." This tint of the bricks may be preserved and heightened by using mortar of the same tone or tint. Furnace ashes and lime will produce a dark mortar, pounded red brick or red tile mixed with lime will give a red tone to mortar, and cheap mineral colors may be added to mortar for pointing. The color of mortar is sadly neglected, as generally the same white lime and sands are used for all tones of color in brick, and not unfrequently white putty mortar is used for pointing the reddest as well as the lightest colored bricks—the light colored work having harmony of breadth and keeping, the red portion being frittered and broken up by the contrast between bricks and beds and joints.

Ventriloquism.

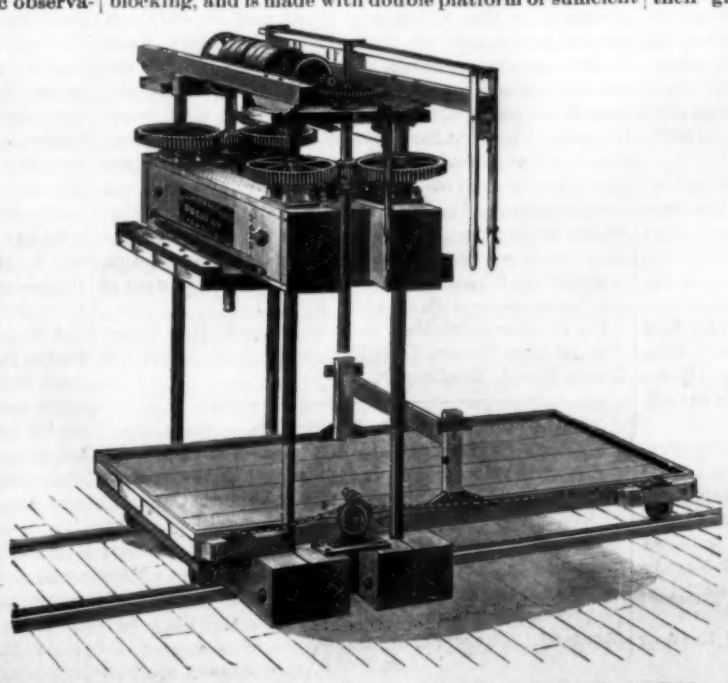
At a recent meeting of the Physiological Society, Berlin, Herr Meyer, from Hamburg, discussed the nature of ventriloquism, and combated the opinion, so widely spread among physiologists, that it consists in speaking while inspiring, and without the cavity of the mouth acting in any way as a resonator; on the contrary, ventriloquists speak while expiring, and do move their mouths. An extended series of laryngoscopic observations on the speaker, who has practiced ventriloquism for many years, has shown that in ventriloquizing the vocal opening of the larynx is shortened as it is when producing the falsetto, and that the soft palate is pressed back and that the uvula becomes invisible. Everybody who naturally possesses a high voice can easily learn to ventriloquize. One most important factor in the deception of the listeners is the contrast between the loud, full, and metallic tone in which the question is asked and the answer which immediately follows in a high and gentle falsetto. Sibilants and the high *I* should be as far as possible avoided. The speaker then gave a series of extremely successful examples of ventriloquism, which did not presuppose any particular training, and showed that it is never accompanied by any special action of the abdominal muscles. Prof. Gad has made some experiments on Herr Meyer, and by graphically recording the variations in pressure of the air, has shown that the curve obtained when a certain sentence is spoken in the ordinary way is in all respects identical with the one which is described when the same sentence is spoken ventriloquially. In the latter case the volume of air expired was considerably less than during normal speech; in one particular case it amounted to only 900 c. c., whereas during normal speech the volume expired was 1,300 c. c. Dr. Benda expressed his idea that when ventriloquizing, the Eustachian tubes are open, and the cavity of the tympanum, together with the tympanic membrane, are set into simultaneous vibration. He had not been able to detect any resonance of the tympanic membrane in Herr Meyer; but he believes that this explanation of the curiously veiled tones emitted is not thereby invalidated, since they closely resemble the tones produced by speaking while yawning, in which case the Eustachian tubes are certainly open and the tympanic cavity acts as a resonator.

HAND AND POWER PRESSES FOR INDUSTRIAL USES.

The variety of uses for which hand and power presses can be advantageously employed is being constantly enlarged by the great improvements which inventors and manufacturers have made in this line within a comparatively recent period. In the accompanying illustration is represented a power screw press, largely used in packing houses for pressing the water and grease from offal preparatory to drying for the manufacture of fertilizers. It is made by the Boomer & Boschert Press Co., of Syracuse, N. Y., and has been adapted to a line of work for which presses of this character have not hitherto been considered available. It gives the same pressure at any point, thus pressing a small as well as large amount of material without blocking, and is made with double platform of sufficient size to hold a "cheese" of the material upon each end. The material to be pressed is inclosed in cloths and placed in layers three to four inches thick, a rack of narrow strips of wood being placed between each layer, affording channels for the water and grease to run off. The platform being mounted upon trucks has a movement sufficient to bring either cheese under the press, permitting the laying up of one while the other is being pressed.



SELF-OILING CONCAVE WASHER.



BOOMER & BOSCHERT'S POWER SCREW TANKAGE PRESS.

A feature recently introduced by the company is shown in the sectional view of one end of the head beam of a screw press, being a patent concave washer and oil reservoir. This concave washer is self-adjusting, so that the springing or warping of the head beam has no effect on the screws or on the bearings for the nuts, while a flange projects upward from the seat through the washer and into the nut, which is recessed to receive it loosely, forming a cup or reservoir filled with oil, in which the screw nut turns. A small groove planed across the face of the nut allows the oil to cover the whole surface at each revolution, thus keeping the surfaces constantly lubricated.

All the presses made by the Boomer & Boschert Press Co. have an indicator by which the operator is enabled to put on more or less pressure as desired, according to the material in the press, and can always measure the pressure used as accurately as it could be determined by steelyards or scales. The company make a great variety of presses for many different purposes, prominent among which we may mention those for oleo, lard, and paraffine oils, cottonseed, castor, and cocoanut oils, leather belting, for tanners' and curriers' use in preparing the leather for splitting, or in the after manipulation in making imitation pebble goat, glove grain, etc., also for knit goods, paper and book presses, baling cotton and woolen goods, vulcanizing rubber, and for many other uses. Having been established in 1874, they have had large experience in the pressing of different products. A very extensive branch of their business is the manufacture of cider machinery.

Electric "Sunstroke."

M. Defontaine, doctor in chief to the Creusot Steel Works, in a paper read before the French Society of Surgeons, states that workmen employed in operating the electric forges at Creusot are subject to a form of sunstroke, which he attributes to the intense light radiated from the focus of the forge. Ordinary arc lamps are incapable of producing such effects, as the light is not sufficiently intense, but these forges emit a light of more than 100,000 candles from a few square centimeters of surface, producing on men exposed to their glare physiological consequences previously unheard of. Freqently, after two or three hours' work, the men complain of pains more or less intense in the neck, the face, and the forehead, simultaneously with which the color of the skin is changed to reddish brown. Further, in spite of the precaution taken by the men of shielding their eyes with dark glasses, the retina is affected to such a degree that for some minutes after ceasing work the operatives are totally blind to all objects illumined with common daylight, nor is perfect vision restored till nearly an hour after. The conjunctiva are irritated, and remain in a state of congestion for forty-eight hours, and this is accompanied by a painful feeling, as of some foreign body introduced under the eyelids. The secretion of tears is augmented, a constant flow being kept up for twenty-four hours, during which the patient suffers from insomnia, due to pain and the abnormal flow of tears, and possibly also to fever. During the following days the skin peels off the face and neck, which become of a deep red color, fading away about the fifth day. In cases of ordinary sunstroke, heat may have some influence, but in those considered above, the whole effect is due solely to the action of an intense light.

Timber Piles and the Teredo—A New Invention Wanted.

The chief engineer of the San Francisco harbor commission has recently made a report on the experiments ordered to be carried out with piles prepared by various methods, with the view of determining the best way of competing with the *Teredo navalis*. In June, 1882, in pursuance of the orders of the board, ninety-nine piles were driven in Mission Street pier 1, then being constructed. During the past month, after an exposure of five years and four months, one or more of the piles of each method, and four unprepared, or naturally bark-protected piles, were removed for examination. When deemed best, a sample of these piles was preserved for future examination. The various methods were given the names of the inventor or experimenter to identify them, and proper records were made to distinguish them. All of the prepared piles were barked for a distance of 40 feet, which was the length treated.

A. W. Von Schmidt, of San Francisco, prepared two piles by jacketing the driven pile with sewer pipe, and filling the space between the pile and pipe with concrete or grout composed of sand, gravel, and Portland cement. The cost of this covering, exclusive of the cost of furnishing and driving the pile, was 75 cents per linear foot, or 30 dollars per pile—a total of 60 dollars for the two. One of these piles was removed. It was found that the teredo had not attacked it, but near the upper part one or two sections of the sewer pipe had been broken and the limnoria had weakened the pile about one-fourth or one-fifth of its original strength.

Frank Shay, of San Francisco, prepared twenty-three piles at 25 cents per linear foot, or 10 dollars per pile. His method was a modification of the Culver process, or a covering of asphaltum and burlap. The modification consisted of a substitution of wire cloth for the burlap. The pile was given a coat of hot asphaltum, then wrapped in the wire cloth and given a second coat of asphaltum, dusted over with sulphate of lime. Two of these piles were removed, and found so badly injured as to break in drawing them from under the cap. Only traces of the covering were left.

James McKeon & Co., of Oakland, prepared ten piles, at 16½ cents per lineal foot, or 6 dollars 50 cents per pile. The protecting coat consisted of so-called "marine cement," applied, whitewash fashion, in four coats. The composition of this marine cement was kept secret, except that it contained an "extremely poisonous substance of great efficacy." This coating did not adhere well in driving the pile. Two of the piles thus prepared have been removed, and both had been practically destroyed by the teredo.

W. H. Raye, of Oakland, prepared twenty piles, at 16½ cents per lineal foot or 6 dollars and 45 cents per pile. His method of protection was similar to the one just described, and the material used was a wash of Portland cement and other secret ingredients. The two Raye piles removed were practically destroyed by the teredo. Pearce & Beardsley, of Oakland, prepared forty-four piles at 34 cents per foot and 13 dollars and 55 cents per pile. Their covering was another modification of the Culver process of burlap and asphaltum, and was a covering of burlap, saturated with "Pearce's compound," a mixture of naphtha and carbon bisulphide, with a small proportion of limestone, kaolin, sawdust, and sulphur. Of the piles thus prepared, two were removed. One had been practically destroyed, and the other seriously attacked.

There were driven at the same time, and in the westerly part of the pier, eleven cedar piles. Two of these were removed and found very slightly attacked—practically as sound as ever, although the bark fell off in removal. It is to be regretted that these piles were not subjected to a more severe test, and unless otherwise ordered, they will be redriven in that part of the water front most infested by the teredo, so as to further test their resistance powers.

In August, 1882, two eucalyptus piles, furnished by Mr. William T. Coleman, were bolted under the same pier. In October, 1886, one of these was removed, and found very seriously injured by the teredo, and the sap wood above water had rotted to a depth of 1½ inches. Four yellow fir piles driven at the time of construction were also removed for comparison. All had been very slightly attacked, but not one of the four so seriously as to in any way impair its strength. Many of the fender piles, however, had been entirely cut off, and the mooring and cluster piles destroyed.

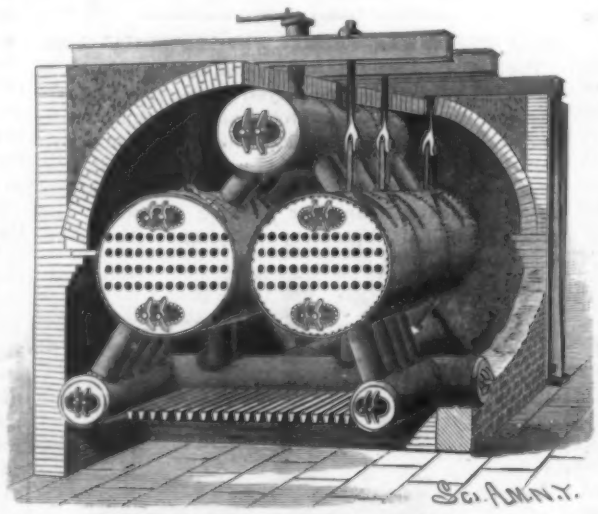
To sum up: The coatings applied by the various experimenters, depending upon their adhesion to the pile, utterly failed to afford even the protection given by the bark. This has been the history of such experiments in other places. Of the eight coated piles removed belonging to Shay, McKeon, Pearce & Beardsley, and Raye methods, but one retained sufficient strength to permit its removal, and this one was more severely attacked and damaged than any of the four "unprotected" piles pulled up or the cedar piles. These results are however not wasted, as they afford valuable guides for the future to those unacquainted with the history of pile protection, and point out what lines of experiment may be avoided.

The Von Schmidt trial was not a new experiment, as this method has been tried elsewhere—notably at Galveston, Texas—and found too costly and liable to injury to compete with the old fashioned and efficient creosoting process. Considering the fact that about 45 per cent of the gross receipts of this board have been spent in wooden structures, and that about twice to twice and a half the cost of a pier is spent in repairing it before the entire renewal becomes necessary, this question of pile preserving is most important, and it is recommended that more extended and better directed experiments be made.

AN IMPROVED STEAM BOILER.

A boiler which is designed to quickly generate steam with great economy of fuel, and in which the sediment in the water will not settle in the main boiler, is shown in the accompanying illustration, and has been patented by Mr. Joseph Leightham, of Lebanon, Pa. The grate bars are inclosed on two sides and at the rear by water tubes, from which branch pipes lead upward and connect with the front part of the water space in the main boilers, the latter being held suspended in the furnace by means of rods from beams extending across the top of the furnace, whereby expansion and contraction from variations of temperature is adequately allowed for.

From the steam spaces of the main boilers branch tubes lead upward, opening into and supporting a superheater, placed above and between the boilers, and from the rear part of the water spaces in the boilers



LEIGHTHAM'S STEAM BOILER.

branch pipes extend downward and open into the mud drum, which is supported partly by the pipes and partly by the end wall of the furnace, through which one end of the mud drum passes. The rear ends of the boilers are covered by an arch extending to the rear wall of the furnace. Besides the heating effect exercised upon the water tubes at the sides and rear of the grate bars, the products of combustion pass beneath and around the main boilers toward the rear wall of the furnace, then pass through the flues in the boilers to the front end of the furnace, and back again around the superheater to the chimney at the rear, part of the heat from the grate bars passing up directly between the boilers and around the superheater to the chimney. With this construction a good circulation is assured of the water in the boilers and tubes, and the sediment naturally settles in the mud drum, from which it can be conveniently removed through an opening in the outside of the furnace at the rear. The active circulation of the water in boilers so arranged of itself tends to partially prevent incrustation, but it will be observed that the flue tubes in the main boilers are here arranged directly over each other, so that all scale cleaned from them will fall to the bottom of the boiler, and not lodge on the lower tubes, thus facilitating the cleaning. The boiler here represented is also intended for connection with a blast furnace boiler which has three returns of gas, doing away with all extra firing.

For further particulars with reference to this invention address Messrs. D. & E. Kremp, of No. 228 North Tenth Street, Reading, Pa.

El Canon Neumatico.

We have received from Havana a handsomely printed and illustrated monograph of 38 pages, in the Spanish language, entitled as above, "The Pneumatic Cannon," by Don Severo Gomez Nunez, captain of artillery. This officer spent some time here in watching the experiments of Zalinski. In this monograph, the author gives a concise and interesting history of the rise and progress of the new weapon, with details of the results obtained. The work, doubtless, will be of much value to all officers, naval and military, of the many Spanish-speaking countries.

Fashionable Electric Lights.

The ball room of Mr. Ogden Mills' residence, 69th Street and 5th Avenue, was lighted by means of the New York Isolated Accumulator Company's storage batteries, on Monday night, 16th ult. The occasion was a ball and house warming, and a large assemblage of the leading members of New York society were present. The ball room was brilliantly illuminated by sixty 16 candle power lamps—the electricity being supplied from the batteries which had been charged on the previous Friday at the Electrical Accumulator Company's factory, Newark, N. J.; carted to Mr. Mills' residence on Saturday; placed in position in the cellar, and connected with the lamps on Monday, and used from 9:30 P. M. until 3:30 A. M. the following day, without a single interruption of any kind.

The effect of the lights was very beautiful, and many expressions of admiration were heard on all sides.

Mr. Cornelius Vanderbilt ordered sufficient storage batteries to illuminate his Fifth Avenue mansion on the occasion of his grand ball given on the 23d ult.

This is the first instance in which storage batteries have been used in America to furnish temporary light for special social occasions, and its success is likely to lead to a large business of this character in all prominent cities. This company uses the Faure battery, so says the *Electrical Review*.

A Chance for American Inventors.

The London *Evening Standard* says: It is not often that the inventive genius of Englishmen fails to meet the requirements that are made upon it; but the reports of Sir Frederick Bramwell, Sir Digby Murray, and Mr. J. Thorneycroft, the judges named by the Royal National Life Boat Institution to examine the models and drawings sent in for competition for the gold and silver medals offered by the Institution, show that for once the problem presented has baffled our inventors. The Life Boat Institution were desirous, if possible, of substituting mechanical power for oars or sails, and invited plans for the best model of a mechanically propelled life boat, and for a propelling power best suited to the existing self-righting life boats of its own fleet. The judges have reported that, after carefully examining the plans and models submitted to them, they are of opinion that none of them is suited to the requirements of the Institution, and are therefore unable to award the medals. It is, indeed, a difficult problem for inventors to grapple with. Life boats are large craft, and require considerable power to drive them against a gale in their teeth; space is precious, for not only has the crew to be carried, but a freight of rescued people; the weight of the propelling machinery must not be great, or it will overcome the buoyancy of the air chambers, and the boat will no longer be a life boat; it must be placed so low down as not to interfere with the self-righting properties of the boat; it must be strong enough to withstand the roughest usage and the shocks and jars that are entailed by the violent pitching of the craft in a heavy sea. It is hardly a matter for surprise that this combination of difficulties has, so far, baffled inventors.

Remarkable Rescues by St. Bernard Dogs.

It is only within the last few days that particulars have been published in the Swiss papers of a brave rescue effected on Mont St. Bernard on the night of the last Sunday in November. While a violent snow storm was in progress, Grand, the manager of the hospice, noticed that his own special dog that was alone with him in his room became very restless, and made signs to him to go out. He took the lantern and fog horn and went out on the mountain, the dog leading him. In a very short time he heard a call and groaning, and, helped by the dog, dug out of the snow an Italian, whom he carried on his back into the hospice. The rescued man stated that his father, two brothers, and another Italian, all journeying home with him over the pass, lay buried in the snow. He had pushed on to obtain help, but had been overpowered by the storm. Grand made ready and went out again. This second search was more tedious and led him further away, but at last the barking of the dog announced a discovery. It was the Italian stranger who was now saved and carried up to the hospice. A third time Grand and his dog sallied out into the tempest, and after a quarter of an hour's search found the others, near where the second man had been discovered. They were quite buried under the snow and almost insensible. He took the most feeble on his own shoulders, and with difficulty conducted the others to the hospice. It was now past midnight, and his toilsome task had occupied Grand over four hours, in a blinding snow storm.—*London Times.*

NEW YORK CITY educates about three hundred thousand children annually, in one hundred and thirty-four school buildings, covering an area of thirty-five acres. These buildings placed side by side would extend more than two miles. There are about four thousand teachers, and the annual expense of these schools is about four million dollars.

ERECTION OF THE NEW HARLEM RIVER BRIDGE AT 155T STREET.

The series of bridges of various epochs and types of construction that cross the River Thames have long been one of the most impressive features of London. From a similar standpoint, and as far as bridge architecture is concerned, the Harlem River, more diminutive than the Thames, bids fair to fill a similar *role* in the city of New York. The High Bridge, carrying the water of the Croton aqueduct across the river, has long been a famous structure, though in the present age it must take a lower position in the engineering world. A short distance from it, where One Hundred and Eighty-first Street intersects the Harlem River, the greatest of the bridges over the river is rapidly approaching completion.

At this point the Harlem has high banks, the west being the more precipitous of the two. On the eastern side the low shore runs back a short distance and then somewhat more gradually rises to a height corresponding to the other side. On the low ground on the east bank of the river the New York City and Northern and the New York Central railroads have their tracks. This character of the ground necessitated the peculiar disposition of the bridge which we are about to describe.

It is a combined masonry, steel, and wrought iron structure, affording a carriageway and foot walks. It includes in general two approaches and the bridge proper. The total length, including these approaches, from Tenth Avenue on the west to Aqueduct Avenue on the east, is 2,380 feet.

The general plan may be thus stated: The length is divided into three parts. Each approach is 660 feet long. Two steel arches and a central stone pier fill up the remaining 1,060 feet left between the approaches. The western approach is for 260 feet in earth supported by stone work. The next 400 feet are in masonry, three semicircular arches of 60 feet span, carried on piers, with some viaduct or solid work completing this portion. On the eastern side a similar division exists. In the approach 300 feet are in earth supported by masonry, while the remaining 360 feet in masonry include one seven centered 56 feet arch, three semicircular 60 feet arches. In common with the bridge, the approaches furnish a clear width of 80 feet, 50 of which is devoted to the central carriageway, and 30 feet are equally divided between the two sidewalks.

We illustrate the general operation of erecting the arches. As will be seen, the work is far from complete, but the difficult parts are pretty well disposed of. We have already described and illustrated the sinking of the foundations.* A good rock bottom was obtained for the piers. When all is in place, the maximum pressure on the pier bases will be about eight tons per square foot. This is well within the limits. The primitive gneiss rock of the New York district could safely be trusted with a much greater load.

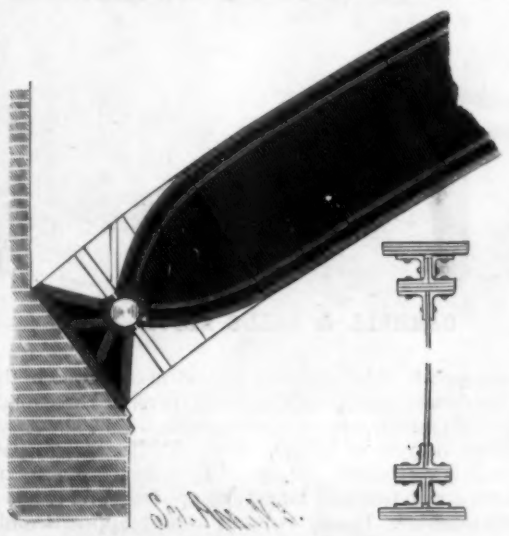
Each approach terminates in a pier, and midway between these is a central pier forty feet deep. The three are carried up to the level of the roadway. The central pier stands on the east shore of the river. Near the foot of each pier the skewbacks, from which the arches spring, are placed. Thus the spandrel is defined by the steel arch on one side, and by the stone pier on the other.

Each arch consists of six ribs, composed of steel plate web, with divided upper and lower chords. The divisions are so arranged as to divide the ribs into voussoirs, that drop into place exactly as do the stone blocks in a masonry arch. Taking a single rib, we find it characterized by heavy top and bottom chords, divided at each joint and connected by steel web plates $\frac{5}{8}$ inch in thickness, except the end web plates, which are $\frac{3}{4}$ inch in thickness. The cross section is shown in the small cut.

The top and bottom members are built up of six angle irons 6 inches by 6 inches by $\frac{5}{8}$ inch, of two plates 12 inches by $\frac{3}{4}$ inch, and three or four plates 20 inches by $\frac{3}{4}$ inch. These pieces are riveted together so as to form two lines of flanges, one pair resembling a top chord and the other a bottom chord of a curved plate girder. The voussoir divisions of each rib are of varying length, but of a uniform horizontal dimension or projection of fifteen feet. The abutting faces are planed. To unite them, angle irons 5 inches by $3\frac{1}{2}$ inches by $\frac{5}{8}$ inch, four in number for each splice, are used. The ribs are 13 feet deep. Each one has its own pair of skewbacks. These bear against the masonry, and support the end thrust. They are thirteen feet long and four feet four inches wide. They have bearings for pins, against which the corresponding ribs abut. Each pin is of forged steel, eighteen inches in diameter and thirty-five inches long. For its entire length it is supported in its bearing by the skewback, a little over one-half its cylindrical or circumferential surface projecting therefrom. At the end of each rib the top and bottom chords converge, and a second bearing or bed is formed, that receives the projecting surface of the pin, a free space being left between the skewback bearing and terminal of the rib. Thus a species of hinge joint is formed that secures a true thrust undisturbed by varying load and changes of temperature. As the rib can oscillate freely in such a bearing, no destructive strain is possible. This joint is also illustrated in the small cut.

Each rib should thus end in a sort of point. To preserve appearances, the general contour of parallel top and bottom lines of the rib was preserved, although the extra plates used are loosely joined and really do no work. This is a concession to the public. To the engineering eye, the display of the pivotal bearing would have been an interesting feature. With an extreme range of temperature, a rise and fall of the crown of arch through a space of three inches may occur, and many times this amount is provided for by the pivotal bearing.

The six ribs thus constructed and supported are spaced laterally 14 feet from center to center. Their rise is 90 feet. They are connected by bracing that may be resolved into two systems. One set, of wind bracing, lies in the line of upper and lower flanges or chords of the ribs; the other, of sway bracing, extends from rib to rib at each junction of the voussoirs or panels. From the upper surfaces of the arch vertical columns rise, upon which the cross floor beams rest. These columns are 15 feet from center to center, and they determine the varying length of the rib panels, already alluded to, as each column starts from the termination of a joint between the voussoirs. The two main arches, one spanning the river, the other the railroads, streets, and low ground on the east bank, are identical in construction. In their construction about seven thousand five hundred tons of iron and steel are employed.



PIVOT BEARING AND SKEWBACK—CROSS SECTION OF ARCH RIB.

The skewbacks, pins, and bearings are of forged steel. The arch ribs are of steel. Both open hearth and Bessemer steel is used, provided the contract requirements are fulfilled. These requirements call for an ultimate tensile strength of 62,000 to 70,000 pounds to the square inch, an elastic limit of not less than 32,000 pounds, with a minimum elongation of 18 per cent. The bracing, vertical posts, and floor beams are of wrought iron. Most of the riveting is done by machine, air riveters being used for work *in situ*. Before being riveted together, all abutting surfaces were painted. Rivets $\frac{7}{8}$ inch diameter are used throughout.

The roadway is to be in granite blocks. Its surface is 151 feet above the level of the river. The intrados of the arch is 133 feet above the same.

The structure has been erected so as to carry out in all respects the best engineering practice. Thus the rivet holes are so accurately spaced that when abutting pieces are in place, a rivet one-sixteenth inch less in diameter than the hole can be passed through the corresponding holes when it is hot. Where holes are punched in steel, they are reamed one-eighth inch larger, to remove all the sheared surface. Where steel has been sheared, it is planed off one-fourth inch back of the cut. The strains allowed vary from 10,000 to 20,000 pounds per square inch. In estimating bending strains the web plate of girders is not included, and for shearing strains the web and no other part is assumed as acting. This insures a still larger factor of safety. These are cited as sample requirements. Through all the details of masonry and iron work the same careful practice prevails.

The arches are built on centering or false work, which for so large and high a span is itself no small construction. We illustrate the false work under one of the great arches, showing how complicated it is.

The bridge is erected under the supervision of Mr. William R. Hutton, chief engineer. He is assisted by Mr. Theodore Cooper as consulting engineer. To both of these our thanks are due for their courtesy. The contractors are the Passaic Rolling Mill Co. and Mr. Myles Tierney. With its two immense archways and general boldness of design, it will for many years be an ornament to the city. But a few years ago a single span of this length, save in a suspension bridge, would have been considered wonderful. At the present day we are inclined to the opposite extreme, and accept all engineering achievements with too little appreciation of their merit.

* See SCIENTIFIC AMERICAN, vol. 56, No. 16.

The Recent Foggy Week in London.

Day after day there was no perceptible movement of the air; and as a natural consequence, the fog grew blacker and more dismal, until at last the distinction between night and day became purely imaginary. An enormous amount of gas must have been consumed, for the fog was very general over the United Kingdom. Fortunate were the gas managers who were able to begin the week with full stocks, and were prepared day after day to let the public have as much gas as they wanted.

To read of fleets of vessels kept outside harbors, of trains running into each other, of men walking into canals, mail carts going astray, and the other results of a dense and universal fog, is far more impressive than anything that newspaper writers can remark upon the subject. The worst of it is that the world which suffers from fog, reads of the mischief brought about thereby, and would do anything to be delivered from fog, forgets all about the matter as soon as a breath of wind drives the unpleasant visitor away. It is more than probable that if a kind of respirator and eye protector for use in foggy weather were to be offered for sale in shops, it would remain dead stock all the year round, even although its merits were so conspicuous as to insure a great sale during the actual prevalence of fog. The climate of the British Isles is so notoriously inconstant in all its modes that we who have to endure its fickleness do so without any more thought than that a change will be sure to come speedily over whatever meteorological conditions may prevail at the moment. Thus it is that we suffer more from cold than Russians or Canadians, and from heat more than West Indians, simply because we cannot depend upon any such continuance of frost or sunshine as would warrant our adapting our way of living to either condition. So it is with fogs. We know perfectly well that there will be a dozen or more foggy days every winter, but this knowledge does not make the slightest difference in our domestic arrangements, even though we may know that there is a clear connection between the two. No Englishman will think it worth while to seriously modify his fire grates and cooking stoves solely on account of fog. His fire in winter is a permanent institution, while fog, which the smoke of the fire makes more objectionable than would otherwise be the case, is a passing infliction. Consequently, the fire blazes, glows, and smokes indoors, winter after winter, while the fog crawls over the land fitfully, and its nauseousness to him while out of doors only makes the Briton stir his fire more briskly when he gets home.

Some of the newspapers have published the usual flood of nonsense, to the effect that smoky household fires, which are admittedly the cause of the most irritating characteristics of town fogs in England, are willful productions of the callous or ignorant householder and his yet more reactionary builder; and one writer whom we have noticed goes so far as to declare that nothing but a severe law, rendering it penal in anybody to purchase or use a smoky fire grate, will ever awaken Englishmen to a proper sense of their duties in this respect.

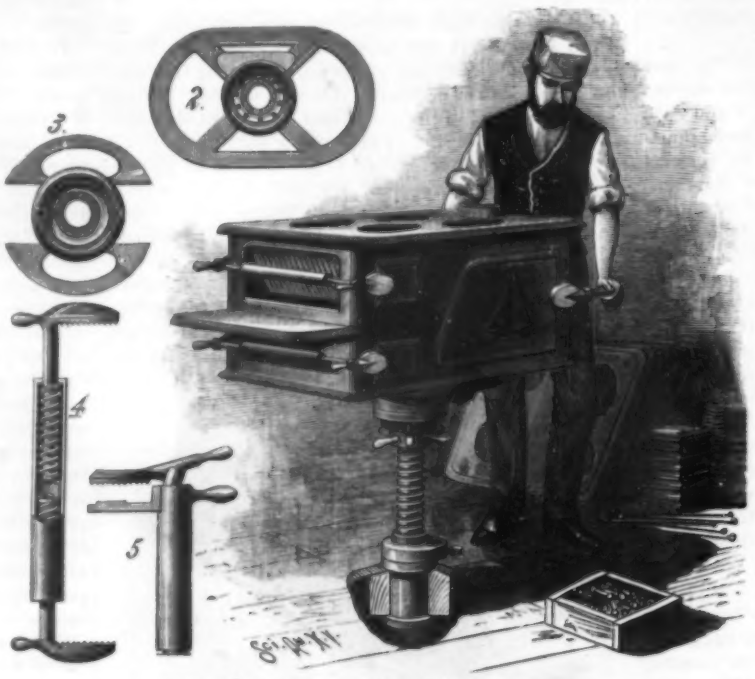
Before we can pass an act for the suppression, under penalty, of smoke from house chimneys, we must be in possession of the material means for carrying out the reform, and of this there is no prospect. There are, of course, degrees of excellence, in the smoke prevention sense, in fire grates, but calling a grate smokeless is like calling a building fireproof. In both cases the point really depends upon the quality of the contents. No grate is smokeless until the fire is out, just as no building is fireproof if it contains combustible materials.

If the virulence of English town fogs is ever to be abated, it will be by dint of steady, quiet, unobtrusive alterations of domestic arrangements which it would be beneath the dignity of a newspaper writer to notice. It is not too much to hope that in time the production of smoke from house chimneys will be stopped for at least the summer half of the year, owing to a general use of gas cooking stoves and kitcheners burning small coke. Already there is a very sensible difference in this respect, for in entire rows of houses in many towns not a single fire is lighted for months together. The more that gas is popularized among the poor, by weekly collections of rental, automatic prepayment meters, and similar devices, the more smokeless will our towns become, for the humblest workman's wife is the most likely to appreciate the labor and time saving capabilities of the simple boiling stove for preparing the early cup of tea, and it is the small fires otherwise required for such a purpose that make the most smoke. Smokelessness in summer is a very good object for immediate endeavor; winter smokelessness is a more serious problem. Abuse it as we may, the cheerful open fire of coals is most suitable for combating the chills and damps which make up an English winter.—*Journal of Gas Lighting.*

FITTING TOGETHER PARTS OF STOVES.

An invention to facilitate the fitting together of parts of stoves, as the several pieces are assembled from the different departments of the foundry and finishing shop, has been patented by Messrs. William Carroll and Charles A. Hill, and is illustrated herewith. It consists of a table mounted to revolve on and be locked to a disk adapted to be raised or lowered, Fig. 2 being an inverted plan view of the table, Fig. 3 showing a modified form thereof, Fig. 4 illustrating a device for supporting the doors of the stove, while Fig. 5 shows one of the clamps. The table has a series of openings through which are passed the bolts and stay rods for securing the sides, ends, and top of the stove together, and in the middle of the table is a downwardly extending projection or hub, with an annular groove fitting on the top of a disk held on the upper end of a screw whose lower end is held in a nut in the floor. The double clamp, for holding the stove doors in place while fitting on the pintles, handles, etc., has a sleeve, in each end of which is held a rod on which operates a spring, the outer end of the rod having a handle and toothed jaw, one jaw fitting over a door of the stove, the sleeve passing crosswise over the stove, and the other jaw pressing against the opposite side. The form of table shown in Fig. 3 is mainly for small round stoves. The tables can easily be raised or lowered to suit the convenience of the workman, are free to revolve so that the workman can conveniently get at all sides of the stove without changing his position, or can be fixed at any desired point.

For further particulars relative to this invention, address Mr. S. M. Oldham, 131 West Goodale Street, Columbus, Ohio.



CARROLL & HILL'S STOVE BLOCK.

A STEAM TRICYCLE.

For several years the problem of steam locomotion on ordinary roads has entered a new sphere. Instead of the heavy and cumbersome traction or road engines which are without speed, and are used principally for moving merchandise, small "automotive" vehicles have been substituted, which, being lighter and of greater speed, may be used for the transportation of travelers and for pleasure journeys. The steam tricycle of Messrs. Dion, Bouton & Trepardoux belongs to this class.

By the use of a small steam boiler of their invention, Messrs. Dion, Bouton & Trepardoux obtain a speed of 25 miles an hour, and at the same time have kept to a very high standard the lightness and size of their machine. Their first carriage was constructed simply by way of experiment. The inventors have, however, been perfecting their model, and have made it a practical machine for the purpose for which it was intended. They have constructed machines of several different models, such as phaeton, cart, delivery wagon, and, more recently, tricycles with one and two seats.

The one we illustrate has a single seat and a detachable single-seated car. It is a tricycle with the ordinary steel wire wheels with India rubber fellies. It is steered by the two front wheels, which are 30 inches in diameter. The back wheel is the driving wheel. It is 23 inches in diameter. On the carriage, and between the wheels, is placed a small steam boiler, which holds 5 quarts of water, and in front of this the water reservoir, which holds 9 gallons. At the rear at each side of the driving wheel are the cylindrical fuel boxes. The bicyclist is seated on a seat mounted on springs over the driving wheel. His left hand rests on the steam valve and his right on the steering device. All the parts which it is necessary to operate while the machine is in motion are within easy reach. The brake, which is very powerful and which is operated by the foot, bears against the driving wheel and stops the motion of the vehicle very quickly.

The steam cylinder is located directly under the foot rest of the operator. The piston rod, by means of a double crank, actuates the driving wheel directly without the intermediary of chains or cog wheels. The boiler, which is of sheet steel, is welded, not riveted, and has been tested to a pressure of 44 pounds. It is guaranteed for a pressure of 26 pounds. It can convert 31 quarts of water an hour, and under these conditions develops a capacity of one horse power. It has a whistle and various other appliances not necessary to mention. The boiler is fed by a pump which is driven by the piston rod. The escape steam from the cylinder passes into the chimney, which is located horizontally, so that there is no draught except when the machine is in motion, which enables the machine to be left from the moment it is stopped, without danger of the pressure increasing beyond the normal limit. Coke is the fuel preferred, and it gives out no smoke. After the kindling wood has been lighted, the fuel is thrown into a central tube, when it feeds automatically into the fire box, as the coke is consumed. This arrangement, which suggests the system employed in the Choubersky stove, enables one to travel for three-quarters of an hour without coaling up.

The tricycle of Messrs. Dion, Bouton & Trepardoux is very easily managed. It is not necessary to have a man specially for getting up steam and running the machine. It only requires a short apprenticeship to run it without any danger. One precaution to be observed is not to acquire too high speed until the direction to be taken is definitely settled. An amateur with even a little experience on a good road can easily make 18 to 20 miles an hour.

This little machine can go up hill very easily. It can make a grade of 1 in 20 at a rate of 6 miles an hour, with the car carrying a load of 175 pounds, and without the car it can mount a grade of 10 in 100.

I constructed a machine of this description, and I have been using it now for six months, and have traveled over several hundred miles with it to my entire satisfaction.

It is very amusing to drive this little locomotive, which obeys with the greatest readiness every whim of the conductor. If the rider objects to riding alone, he is able to take a traveling companion with him in the car. In conclusion it may be said that the tricycle of Messrs. Dion, Bouton & Trepardoux is one of the most successful and practical road engines that has yet been built.—*Vicomte de la Tour-du-Pin-Verclause, in La Nature.*

NEW FRENCH STEAM TRICYCLE. (From a photograph by the author.)

GROUND coffee digested in cod-liver oil quite overcomes the fishy taste of the latter.

How Paints are Obtained.

Every quarter of the globe is ransacked for the materials—animal, vegetable, and mineral—employed in the manufacture of the colors one finds in a paint box. From the cochineal insects are obtained the gorgeous carmines, as well as the crimson, scarlet, and purple lakes. Sepia is the inky fluid discharged by the cuttlefish, to render the water opaque for its own concealment when attacked. Ivory black and bone black are made out of ivory chips. The exquisite Prussian blue is got by fusing horses' hoofs and other refuse animal matter with impure potassium carbonate. It was discovered by an accident. In the vegetable kingdom are included the lakes, derived from roots, barks, and gums. Blue black is from the charcoal of the vine stalk. Lamp black is soot from certain resinous substances. From the madder plant, which grows in Hindostan, is manufactured turkey red. Gamboge comes from the yellow sap of a tree, which the natives of Siam catch in cocoanut shells. Raw sienna is the natural earth from the neighborhood of Sienna, Italy. When burned, it is burned sienna. Raw umber is an earth from Umbria, and is also burned. To these vegetable pigments may probably be added Indian ink, which is said to be made from burnt camphor. The Chinese, who alone can produce it, will not reveal the secret of its composition. Mastic, the base of the varnish so called, is from the gum of the mastic tree, indigenous to the Grecian archipelago. Bister is the soot of wood ashes. Of real ultramarine but little is found in the market. It is obtained from the precious lapis lazuli, and commands a fabulous price. Chinese white is zinc. Scarlet is iodide of mercury, and cinnabar, or native vermilion, is from quicksilver ore.

Luckily for the health of small children, the water colors in the cheap boxes usually bought for them have little or no relation, chemically, to the real pigments they are intended to counterfeit.—*The Argonaut.*

The Storage Battery.

It is gratifying to note the recent progress of storage batteries in this country, which has been the last to yield from a position of skepticism. The various experimenters have steadfastly plodded along, however, and now it really seems as if the storage battery had come to stay. Upon a careful review of the past, in the light of present knowledge, it seems that a great many of the past failures of batteries to stand up to their duty have been caused by want of knowledge as to the proper treatment of them, the safe current limit in charging and discharging. At the present day the storage battery is as reliable as any other form of battery, and has one great advantage, that, once properly set up and started, and thereafter treated as it should be, a well-made accumulator should last almost indefinitely. Most of the troubles of the past have been due, not to ignorance of how to make the cells, but to a want of knowledge of how to charge and discharge them, causing sulphating, displacement of the plugs, and buckling of the plates, all of which, through the inexperience of the inventors, have seemed fatal and insurmountable objections. To-day, however, their causes are well understood and easily prevented, and the storage battery is fast growing into one of the powerful tentacles of electric science, and will reach thousands of uses and adaptations perhaps as yet unthought of.—*Electric Review.*

Electric Railways.

The *Electrical World*, after investigation, reports that electric railways have so far successfully withstood the vicissitudes of the very severe winter through which we are passing.

To this the *Railway Review* adds that the success has been as marked on the conduit as on the overhead or trolley systems. During this winter weather these roads are operated up grades and around curves where it is found impossible to use horses. This method of car propulsion is rapidly growing upon us. The experimental stage is passed. Next will come a remodeling to suit crowded thoroughfares. After that we can hope for universal adoption.

THE COPPERHEAD.

BY C. FEW SEISS.

Linne, in 1758, gave the first accepted description of the copperhead. He seems to have considered it a non-venomous species, for he first named it *Coluber contortrix*, and in 1766 renamed it *Boa contortrix*, both genera including only serpents without poison fangs. It is now known to scientists as the *Ancistrodon contortrix*, which may be interpreted contorted hook tooth—a name that is neither very characteristic nor euphonious.

I have been informed by persons who "knew all about snakes," that the head of the copperhead is always as refulgent as a newly coined cent, and by this distinguishing character alone it can always be identified. Yellowish brown, brickdust red, and cream color are the only tints observable. I never noticed the slightest resemblance to polished copper. The ground color of the entire upper portions of the copperhead, including the head, varies from light hazel brown to brick red. Lower parts of the head cream color, the line of separation between the upper brown tint being distinctly marked. Fifteen to twenty-four dark brown blotches along the body. They are narrow and contracted dorsally, but forked or widely spread out laterally; the color paler between the forks as it approaches the abdominal plates. Sometimes the dark blotches are broken on the dorsal region; sometimes one or two small spots on the light spaces between the blotches. Under parts flesh colored or yellowish, with a series of large dark spots, thirty-five to forty-five in number, on each side. Lower jaw beneath and throat unspotted. The scales of the back and abdominal plates are more or less freckled with minute dark specks. A small dark spot on each occipital plate. The head is somewhat triangular in shape, with nine plates; the neck compressed, and the snout slightly turned up. A large female in my collection measures 42 inches in length. A male specimen, from New Jersey, captured after it had swum across a small lake, measures 25½ inches.

It is found in certain localities in nearly every State from Vermont south to Florida, and southwestward to Texas and Kansas and the States of the Mississippi Valley. It has not been found west of the Rocky Mountains.

The copperhead is rather sluggish in habits, and not of an aggressive disposition. Unless partially blind when about to cast off its old skin, gorged by a large meal, or come upon suddenly and surprised, it generally glides away, and secretes itself under a pile of rocks, fallen timber, or brush. When forced to act on the defensive, it does not throw itself into a coil, with the tail elevated, as is generally, though not always, the case with the rattlesnake, but throws its neck and body into contracted horizontal S-like curves, with the head slightly uplifted, and thus awaits an attack. The strike is made by instantaneously straightening the curves of the neck and fore part of the body, which, of course, propels the head forward. At the same instant the jaws are stretched widely apart, and the fangs erected by pushing forward the maxillary bones, to which the fangs are firmly fixed. This is accompanied with a downward movement of the head, for the purpose of driving the fangs deeper into the object. Then the maxillary bones are thrown outward, spreading apart the fangs, so that there is no danger of the lower jaw being injured. The poison apparatus of the copperhead scarcely differs from that of the rattlesnake. That persons have died from the bite of the copperhead is possible and probable, yet a strictly authentic case has never come under my notice.

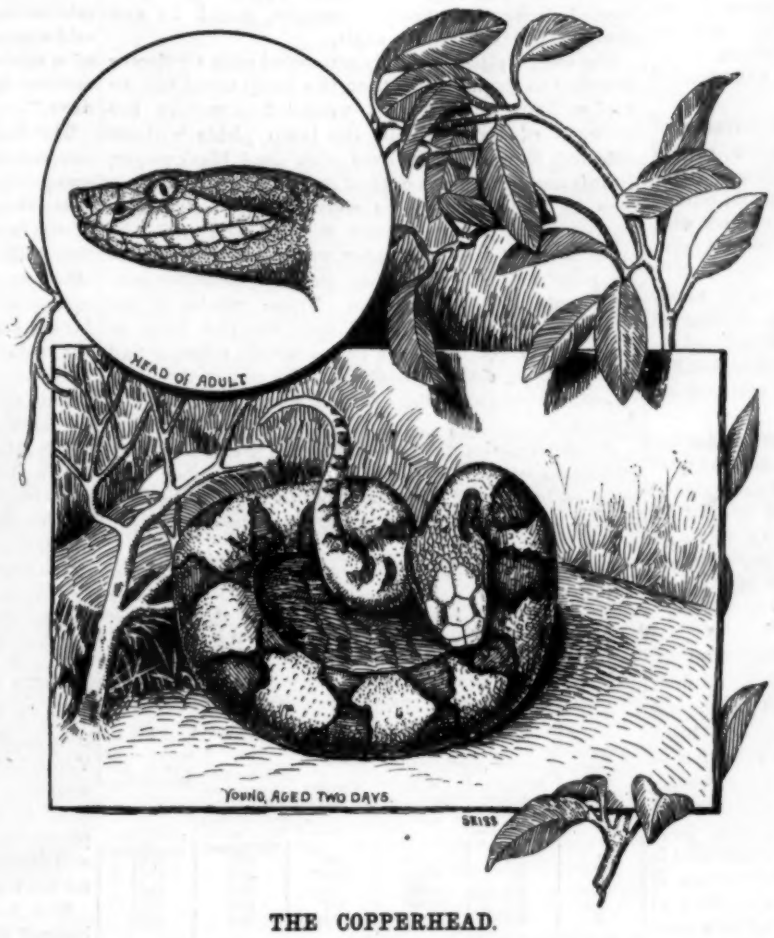
This serpent is viviparous, or, as some prefer, ovoviviparous. The female brings forth young about the middle of September in this latitude. The number produced at a birth varies from five to nine and perhaps more. In a family of nine baby copperheads born in captivity, the average length was about 11 inches. Comparatively they were shorter and more robust in form than their mother, and the ground color of their bodies was paler and the spots seemingly more distinct than in the parent snake.

At certain seasons they are gregarious, and many are sometimes found together in a heap. According to Prof. Allen, Mr. C. W. Bennett found, near Mount Tom, in the months of July, August, and September, small groups of five to seven individuals, all of which appeared to be pregnant females. In autumn, before cold weather sets in, they seek some deep, protected fissure or hole, generally among rocks, in which to pass the winter. They may sometimes be seen sunning themselves near the entrances of their dens, on unusually warm days in early spring before the snow is all melted. They seem to resort to the same retreats for many years in succession. To the copperhead, as well as the rattlesnake, has been ascribed the power of "fascination"—a power which has been accepted and defended by many. I give here a true instance of the peculiar behavior of a bob-white or partridge when confronted by a copperhead:

"I went with several companions to a wood about two miles distant from Hagerstown, Md., for the purpose of gathering the wild haw, with which the limestone ridges in that region are frequently overgrown. The berries likewise attracted great numbers of birds, and the clefts among the rocks offered a safe retreat to reptiles. Coming to an open space in the wood, we were surprised to see a bob-white moving about in a very singular manner. We at first thought that it was performing that wonderful trick by which birds, pretending to be lame, seek to lure the intruder from their nest or young. But we were soon satisfied that this was an entirely different case. The poor bird did not pretend to be lame, but, on the contrary, was unusually active upon its legs. Its movements, however, were very peculiar. It went in a zigzag line, first to one side and then to the other, occasionally hopping forward, and always advancing. At the same time it continued to utter a chirp of great distress. We soon perceived that its eyes were steadily fixed upon a copperhead snake, three or four yards distant. The snake did not appear to be disturbed by our intrusion, nor did it seem particularly intent upon its prey, though its head was elevated from the ground about as much as in its ordinary movements. I think there was also some motion of its tail. One of our number went forward and captured the bird, which was apparently rather relieved by getting into human hands, and soon ceased to tremble, as it had evidently been doing when facing its savage enemy. The snake was soon killed, as it neither made any resistance nor attempted to escape, though it appeared sufficiently vigorous, and was about two feet long."

A friend tells me that once when on a collecting trip, he dropped a bright tin box near a trunk of a tree, and hurried away after a butterfly he saw flying in the wood. On his return, as he approached the spot where he had dropped the box, he was surprised to see a gray squirrel, several feet away from the box, with its eyes fixed steadily upon it, moving nervously from side to side, now coming forward and again backing away a few inches, but never removing its eyes from that mysterious object—the tin box. The squirrel seemed bound to the spot, as if by an unseen cord, and only retreated when my friend approached to within a few yards of it.

We know that a cat in the bushes will sometimes draw small birds near enough to be caught. That it is not any bewitching power exercised by the living animal that produces the attractions is proved by the fact that the stuffed skin of a cat or other bird-catching animal has produced the same "fascinating" or drawing power.



THE COPPERHEAD.

THE name of Wm. Lockerby, inventor of self-adjusting life boat, was erroneously printed Lockerly in the issue of February 4.

Artificial Crystal Pictures.

I send, upon glass plates, specimens of crystals that can be examined at leisure, as they do not, like the water crystals, disappear when the air is above the freezing temperature.

The process of making them is very simple, and may give to your younger readers a taste for chemical studies and for further knowledge of the wonders of crystallization.

The glass plate upon which the crystals are to be formed should be cleaned with a little soda or other alkali. When dry place the plate on a table and have in readiness several thin wedges, with which to make it perfectly level. To one tablespoonful of water add one teaspoonful of chloride of sodium (common salt), making a saturated solution; pour this upon the plate and make it level by inserting the wedges at the sides that are the lowest.

It is best to do this in the evening, and leave the plate at rest during the night, as crystals assume the most perfect forms when free from disturbing causes.

Of the various salts I have used, this most closely resembles the water crystals made by the frost upon windows. The crystals of the common salt are deliquescent and not very permanent. If it is desirable to keep them for study, and measurement of the angles, or for projection on the screen, a coat of very thin shellac varnish should be flowed over the surface. Good results are obtained by the use in the manner here described of sulphate of copper (blue vitriol), protosulphate of iron (copperas), chloride of ammonium (sal ammoniac), sulphate of magnesium (Epsom salts), nitrate of potassa (saltpeter), and bichromate of potassa.

To enhance the beauty of these plates the solutions of those salts that are of light colors may be tinted with a few drops of a solution of aniline. If they are to be copied by the camera, for use in printing, the solution should be tinted with black or orange shades.—*J. M. B., the Swiss Cross.*

Gigantic Forging Press.

Mr. F. A. Krupp, the head of the great Prussian arsenal at Essen, lately visited the Atlas Steel and Iron Works, Sheffield, to witness the action of the gigantic hydraulic forging press lately added to the plant of the Atlas works. This press, which is believed to be the most powerful and efficient tool at present in existence, nominally exerts a total force of 4,000 tons, but its actual full power is considerably greater. Three large furnaces, each capable of heating an ingot of 100 tons, prepare the work for the massive machine, and two traveling cranes, each capable of lifting 150 tons with ease, convey the forgings from the furnace to the press and manipulate them as required. One man, who stands at the floor level in a cage suspended from the crane and traveling with it, has under his hand four valves, by which he lifts, lowers, advances, retires, moves sideways, or revolves the forging on its own axis. A second man works the lever which governs the strokes of the press, and by observing an index in front of him regulates with the utmost nicety the distance from the anvil at which the top tool is to cease its advance. A forge master and several furnace men are also required to superintend and to feed the apparatus; but its working is entirely under the control of the two men referred to. Mr. Krupp ordered one for his own works.

Foreign Adoption of American Passenger Elevators.

The "American Elevator Co.," of London, England, has recently contracted to put up the passenger elevators to be required in the 1,000 feet high Eiffel tower, now in course of construction at Paris for the great French exhibition of 1889. The same company is also under contract to construct eighteen elevators for the Whitehall Court, Thames Embankment, London; in addition to having received orders for six elevators for the Savoy Mansions, Thames Embankment. Elevators by the same company are now running at the Hotel Victoria, Charing Cross, and there are three at work at the National Liberal Club, London, while one has recently been ordered for Municipal Buildings, Glasgow. Of these elevators, the *Iron and Steel Trades Journal* remarks: "The one at the Liberal Club is a fine specimen, and shows the degree of perfection to which lifts have attained in America. Our engineers have again been caught napping. The great hesitation shown by our engineers to go in for new departures is too palpable to be gainsaid." The company thus representing in Europe the practical superiority of American inventors and mechanics in a most important specialty of modern building is a branch of the house of Otis Brothers & Co., of New York.

Correspondence.

Ivy Poisoning.

To the Editor of the Scientific American:

I have read an article in your paper on ivy poison, and as I have had considerable experience with ivy poison, I wish to give a sure and simple remedy which I think I was the first to discover. About 25 years ago I was badly poisoned by climbing trees to get wild grapes. I was literally poisoned all over. My limbs were swollen and broken out with little blisters. My parents were away from home at the time. I did not know what to do. I had heard that salt water was good. I could find no salt in the house, but found some baking soda, so I thought I would try that. I got a large wash basin, put in about 3 quarts of water and about 4 ounces of soda. I then bathed myself good all over. It knocked the ivy poison higher than a kite. I was poisoned several times after that, but always cured myself with the same remedy. Also I know of many cases where they used it on my recommendation, and they all were speedily cured. It is simple and easy to try it. There may be other parties who have used this remedy, but if so, I do not know of it.

S. HEBERLING.

Des Moines, Iowa.

Uses of Saccharine.

Sugar being a prohibited article to me, I naturally became interested in Fahlberg's "saccharine," and obtaining a supply as soon as possible, began experimenting with it. Using it alone to sweeten lemon juice or stewed cranberries, I found it very difficult to mix and tried various dodges to remedy it, all of which had some drawback or other until I thought of dissolving it in glycerine.

I found that for general purposes the formula of glycerine one pound, saccharine one drachm, heated to solution, was the best. Two teaspoonfuls of above to the juice of one lemon made up to eight fluid ounces makes a lemonade sweet enough for almost any one, and three teaspoonfuls to four ounces of stewed cranberries makes a dish "fit for a king."

I gave a sample of above to a gentleman to whom sugar was tabooed, and who was then using saccharine alone, and asked him to try it with cranberries and report. When next seen he said very enthusiastically, "That's splendid. I've bought a barrel of cranberries, and would not go back to sugar if I could."

The advantages of the mixture over pure saccharine are: 1. That the glycerine gives it a body, and the mixture very closely resembles in taste and appearance the best white honey. That it dissolves readily in water, milk, tea and coffee, wines and liquors, and that it can be very readily measured. To those forbidden the use of sugar, I would advise the use of the above.

A. G.

Appleton, Wis., January 25, 1888.

A New Ice-Breaking Vessel.

A remarkable boat is soon to be turned out at the docks of the Detroit Dry Dock Company. It is built for the Mackinac Transportation Company, and is to be used as a car ferry boat. The boat is 235 feet long, 52 feet broad, and 25 feet deep, and will be able to carry ten freight cars or eight passenger cars. It is, however, as an ice crushing machine that the new boat is expected to be remarkable, and her construction is such that it will be impossible for soft ice to cling to her sides. The propelling power is furnished by a compound engine of 2,000 horse power, with 28½ inch and 53 inch cylinders, having a 48 inch stroke, and driving a 12 foot wheel. In addition to this there is another and smaller engine of about half the power, the chief object of which is to serve as an ice breaker.

It has been found that the easiest and quickest way to get ice out of a slip is to back the boat into the ice, hold her there with lines, and then by working the engine forward throw a column of water under the ice, which never fails to break it up and drive it out of the slip. This fact suggested the peculiar feature of the new boat—her two wheels. No. 85, as the new boat is known on the company's books, will go in the ice bows on, and while held there by her larger propeller, the smaller wheel, itself ten feet in diameter, will clear the way into the ice. The top of the buckets of this wheel will be 6 feet under the surface of the water, so that there will be no danger of its being broken by the ice. There are three double-ended boilers, 18 feet long by 11 feet 6 inches in diameter, equivalent to six ordinary boilers. They are placed side by side, and have two smokestacks, one forward of the other, ocean style. Her bow is so constructed as to stand the severest shocks, and her hull is sheathed with steel plates ¼ inch in thickness. Naturally requiring great steering power, a special steam steering engine has been designed for her by the Manton Steam Windlass Works of Providence, Rhode Island. To prevent her rolling in heavy seas, two tanks, holding about 25 tons of water each, have been placed athwartship. An electric light of 2,000 candle light power will be fastened to her pilot house.

Gratzel's Magnesium Lamp.

The following results were obtained with a magnesium lamp of recent construction by H. A. Gratzel, of Hanover.

Since it has been found practicable to produce magnesium electrolytically on the large scale, and the price has consequently fallen within a few years to about one-fifth of its former amount, the attempt has been made to utilize the property of this metal (hitherto little regarded) of burning with great luster, in the construction of sources of intense light. There can be no doubt that with the increasing application of the magnesium light the technical improvement of the lamps will proceed hand in hand. The burner here measured was made for experimental purposes only, but it yields a light burning with sufficient steadiness.

There can be burnt in this lamp as many as eight magnesium ribbons of 2·5 mm. in width and 0·13 mm. in thickness. It is, however, easy to burn any smaller number at pleasure. Even on burning a single ribbon there was no extinction, as it often happened with the earlier lamps. The strength of the light fluctuates more than in a well regulated arc lamp, but the fluctuations are more gradual, so that they are perceptible only on the photometer screen, but not with the naked eye. They certainly occasion disturbance, and I have sought to eliminate their influence by increasing the number of observations. The greater the number of the ribbons burning, the smaller is the relative amount of these variations.

The white fume, in which state a part of the oxide formed during combustion escapes, found its exit through the ventilation shaft.

The escape pipe was firmly connected with a reflector attached to the lamp, so that the lamp could not be used without it. But as I wished to ascertain the strength of light which the lamp yields without reflector, it was pasted over with dead black paper. In this manner the strength of light for different numbers of ribbons could be conveniently determined. Lastly, as the concave mirror will be used with the lamp in many cases, the paper was removed, and after the polish of the reflector was restored, measurements were made with the reflector. These results of the latter, of course, hold good only for the lamp in question. The aperture of the parabolic reflector had the diameter of 39 centimeters. This is not the place to enter upon the details of the construction of the burner.

For determining the consumption of magnesium, the rolls upon which the supply of ribbon was coiled were weighed before and after the experiment, and the time during which the lamp was burning was accurately noted.

The strength of light was measured in the horizontal direction. A few determinations made at 33° (greater angles could not be used on account of the reflector) showed a decrease of the strength of the light of about 25 per cent.

Number of ribbons	Strength of light in normal candles.		Without reflector.		Hourly consumption of ribbon per 100 candles.
	Without reflector.	With reflector.	Candles per ribbon.	Consumption of magnesium per hour-ribbon	
				Grammes.	Grammes.
1	150	3,300	150	16·7	11·14
2	237	5,880	118·7	16·7	14·10
4	450	8,000	112·5	16·7	14·80
6	700	11,300	117	16·7	14·15
8	950	17,000	119	16·7	14·06

The strength of light obtained per ribbon is therefore greatest when only one ribbon is burning. It sinks as soon as a second is introduced, but remains then approximately constant whether two or eight ribbons are in use. The somewhat abnormal result obtained with four ribbons is probably due to an experimental error.

The price of magnesium ribbon is at present 45s. per kilo. If the lamp burns with eight ribbons, it consumes hourly 134 grammes magnesium. If we disregard the first price of the lamp, it costs 6s. per hour burning, and 100 normal candles measured without reflector cost hourly $\frac{33}{100}$ of 1s.

The lamp examined pushes forward hourly 32 meters of each ribbon. This speed appears to be too great, and can be decidedly reduced without reducing the strength of light of the lamp. Some of more recent construction push forward only 24 meters hourly. It appears also that the price of magnesium will shortly be reduced to 30s. per kilo. Hence an eight ribbon lamp would consume hourly 100 grammes of magnesium, at the price of 3s., and the hourly cost of 100 normal candles would be only $\frac{33}{100}$s.

But even this price is still much too high to admit of the magnesium light competing with the electric light or with gas. The natural sphere of the magnesium light is different. It will be used wherever an intense light is demanded for a short time and where gas piping and electric installations are not at hand. For such purposes magnesium is the cheapest source of light. The magnesium light is readily portable, and can be kindled at any moment by means of a match, and as quickly again extinguished.

It is thus suited for military purposes, for luminous effects in theaters, in photography, in nightly building operations of short duration, in ships, etc.

Lamps have also been recently constructed arranged for burning several hours (during which the mechanism does not need to be wound up again), and the greatest intensity of light is thrown, not horizontally, but downward. Such burners are already in use for lighting up large halls, etc.

There is no need in electro-technics to fear the competition of the magnesium light, but one should rather seek to improve the preparation of this metal.—*Centralblatt fur Elektrotechnik; Electrical Review.*

An Iowa Railroad Law.

A remarkable judicial ruling comes from Iowa.* A woman brought an action for damages for injuries received while alighting from a moving train. It appeared that when the train arrived at the station where she intended to get off, it did not stop long enough to enable her to step from the platform of the car. Her two young children who were traveling with her had preceded her and alighted safely before the train started, and it was the desire not to lose them which impelled her to jump after the train had commenced to move. There is a statute in force in Iowa which provides as follows: "If any person not employed thereon, or not an officer of the law in the discharge of his duty, without the consent of the person having the same in charge, shall get upon or off any locomotive engine or car of any railroad company while said engine or car is in motion, . . . he shall be guilty of a misdemeanor, and be punished by fine not exceeding $100, or be imprisoned not exceeding thirty days."

The Supreme Court decides that before the woman can recover she must prove one at least of the three exceptions in the statute, viz.: Either that she was a person employed on the train or that she was an officer of the law, or that she got off the train while in motion with the consent of the conductor or some other officer of the company in charge of the train. If she cannot show any of these things she cannot recover, for the reason that otherwise her act of jumping from the train while in motion was unlawful, and if unlawful it was negligent.

This is a case of strict construction—of sticking in the bark of a statute with a vengeance. Under this ruling, if a passenger on a train in Iowa should see that a drawbridge ahead of the train was open or that another train was approaching on the same track, and rushing to the door should jump off and save his life before the train went into the river or the collision occurred, he would be at once guilty of a crime, and would be liable to a fine of $100 or imprisonment for the space of 30 days, because he did not, before he jumped, hunt up the conductor and ask his permission to leave the car while in motion. History tells us of a Venetian statute which, to discourage street encounters in the time when men wore side arms, made it a capital offense to shed blood in the streets of Venice. It also tells of a physician who, meeting a man in a fit on the streets, lanced him and saved his life. A sensible magistrate decided that the act of the physician did not come within the intent of the statute, and that he was not subject to the extreme penalty for his humane act.

The Iowa Supreme Court would no doubt have hanged the surgeon and reversed the decision of the magistrate. The truth is, as any one can see at a glance, that the Iowa statute was intended simply to punish trespassers for getting on trains while in motion, to steal a ride, and the same persons, or others intending to evade the payment of fare, from jumping off to escape detection by the conductor. To extend it to the case of necessity such as we have alluded to is manifestly absurd, and surely the case of a mother separated from her infant children by the neglect of those in charge of the train, and almost crazed at the thought of losing them, is one of natural impulse and fear of danger, which may properly be deemed necessity.—*Railroad Gazette.*

Garden and Forest, a New Journal.

Those of our readers who are interested in horticulture or forestry will be pleased to hear of the advent of a new paper devoted to these two subjects. Early in February the first issue is promised. The paper is to be published in this city, under the management of Mr. William A. Stiles, who will be assisted in his editorial labors by Professors Sargent and Farlow, of Harvard College, and Prof. Packard, of Brown University. A long list of contributors includes many distinguished names. The name of Professor Asa Gray, of Harvard, lately deceased, still heads the list. We wish the new journal every success, and trust that it will meet with the encouragement it will deserve if it carries out the promises made. The list of contributors assures matter of interest to all. It is to be illustrated, and will appear weekly. Its address is *Tribune* building, New York.

* Raben v. Central Iowa Ry. Co., 34 N. W. Rep., 621.

RE-ENFORCEMENT OF SOUND.

BY GEO. M. HOPKINS.

The re-enforcement of sounds by the vibration of confined masses of air may be readily investigated without apparatus, that is, such apparatus as is commonly employed in acoustical experiments. A very simple experiment illustrating the fact that a sound

Fig. 1.—RE-ENFORCEMENT OF VOCAL SOUNDS.

may be strengthened by a confined body of air is illustrated in Fig. 1. The only requisite for this experiment is a paper tube 16 or 18 inches long and about 3 inches in diameter, or, in the absence of such a tube, a sheet of thick paper rolled into a tube will answer. This tube should be held with one end near the mouth, the opposite end being closed by the palm of the hand. By making a sound continuously with the voice, gradually rising in pitch, for example by singing O, with the voice rising from the lowest note it is capable of making, toward the highest note, a

Fig. 2.—SELECTIVE POWER OF A RESONANT VESSEL.

point will be found where the sound is largely increased. This increase of sound will occur at the same point in the scale each time the experiment is tried with the same tube, thus showing that the dimensions of the tube are in some way related to the re-enforced note, and to that note only. It will also be noticed that the vibrations of the air in the resonant tube not only affect the auditory apparatus, but also have sufficient power to be plainly perceptible to the sense of touch, the vibrations being felt by the hand.

Another very simple experiment showing the same phenomenon in a different way is illustrated in Fig. 2. In this case the resonant vessel consists of a vase. Any vessel of substantially the same form may be used. The size is not very material, but by making several trials of different vessels a particular one will be found which will yield better results than others on account of being of the correct dimensions. The experiment consists in holding the vase obliquely in close proximity to the ear, then running the chromatic scale upon any instrument having sufficient range, preferably upon a piano or organ. Some note of the scale will sound much louder than any of the others. By tilting the vase slightly in one direction or the other, so as to cause the ear to partly close the mouth of the vase, the resonant qualities may possibly be improved, as the movement of the vase in this manner amounts to tuning the resonator.

In Fig. 3 is represented an experiment in which the mouth is employed as a resonator, and an ordinary tea bell as the source of sound. The tuning is effected by moving the tongue back and forth, also by opening or closing the lips. By a few trials a position of the mouth will be found which will cause it to respond to the sound of the bell and act as an efficient resonator.

The familiar instrument shown in Fig. 4 is used in connection with the mouth as a resonator. In this example the reed of the Jew's harp is made to yield a variety of tones, dependent upon the adjustment of the mouth and the force of the breath. The fundamental note of the reed is the clearest and best, and always distinctly heard. The forced overtones are less satisfactory, but suffice for playing tunes that are recognizable.

The experiment with the bell, represented in Fig. 5, is very striking, and is easily performed. The bell is simply an old fashioned clock bell or gong fastened on the end of a small wooden handle by a common wood screw. The resonator is a paper tube of about two-thirds the diameter of the bell, provided with a movable portion or diaphragm, as shown at A. Although the bell may be set in vibration by rapping it with the knuckles or striking it with a large sized rubber eraser, it may be more satisfactorily sounded by drawing a well resined bow over its edge. The bell is held over the mouth of the paper tube, and the diaphragm is moved up or down in the tube until a position is reached in which the bell will yield a full tone, which is much louder than it is capable of giving when used without the resonator. The diaphragm is then fastened by means of sealing wax or glue.

To re-enforce one of the overtones of the bell, the opposite end of the tube is gradually shortened by paring off narrow strips from its edge until it responds to the high tone which the bell is capable of giving out when bowed in a particular way. Now, by causing the bell to vibrate strongly and placing it near opposite ends of the resonator in alternation, it will be found that the deeper cavity will respond only to the grave note of the bell, while the shallower cavity will re-enforce only the overtone to which it is tuned. In this experiment it will be found a little more convenient to have separate resonators for the different tones.

In Fig. 6 is shown an experiment which is substantially the same as that just described in connection with the bell. In this case two tuning forks, A and C, are used as sound producers, and to each fork is adapted a resonator consisting of a paper tube about ⅜ inch in diameter and 8 or 10 inches long. Each tube is tuned to the fork in connection with which it is to be used by inserting a cork and moving it until the length of the inclosed air column is such as to respond to the fork. It will be found that the A resonator will respond only to the A fork, and the C resonator will re-enforce only the sound of the C fork.

In all these cases the resonant tube or cavity corresponds in depth to one-quarter of a wave length of the particular sound which it is adapted to re-enforce. The wave proceeding from the sounding body strikes the bottom of the resonant chamber, and is reflected back in time to proceed with the other half of the wave moving in the opposite direction, greatly augmenting its volume.

The combination of two series of sound waves may be made to produce silence if the relation of the two series be such that the air condensations of one series coincide with the rarefactions of the other series. This may be demonstrated by holding a tuning fork over its appropriate resonator and turning it until the plane of vibration of the fork is at an angle of 45° with the axis of the resonating tube. Then the sound of one arm of the fork will exactly neutralize that of the other arm.

Fig. 3.—THE MOUTH USED AS A RESONATOR.

Fig. 4.—EXPERIMENT WITH THE JEW'S HARP.

Vegetable Glue.

Concentrated solution of gum arabic possesses the disagreeable property, when applied to printing and other paper not strongly sized, to penetrate them to transparency, and, in spite of this, not making them adhere to other paper. Paper cannot be attached to common pasteboard, nor wood to wood by it. Paper gummed with mucilage will not adhere to metallic surfaces, but soon falls off; and it is no use for glass, porcelain, or earthenware. All these disadvantages are remedied when an aqueous solution of sulphate of aluminum is added. For 250 grains of the concentrated gum solution (prepared with two parts of gum and five of water), two grains of cryst. aluminum sulphate will suffice. This salt is dissolved in ten times its quantity of water, and mixed directly with the mucilage, which in this condition may be termed *vegetable glue*. Solution of alum serves the same purpose, but far less efficiently.—*Pharm. Central.*

The Washington Monument.

It is said, by those who are in position to know all about the matter, that the statements going the rounds of the press, in reference to the disintegration

Fig. 5.—BELL AND RESONATOR.

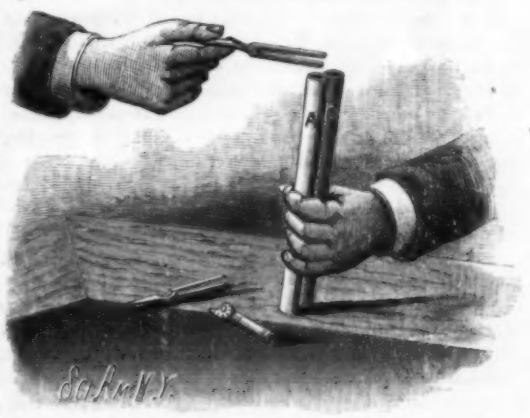


Fig. 6.—TUNING FORKS AND RESONANT TUBES.

of the Washington monument have no warrant in fact whatever.

The foundation of the statements may be traced to slight surface cracks, and some spalling in the outer course of stone of a portion of the old structure. This is due to the fact that when the building of the monument was originally begun, it was never contemplated to sustain the immense pressure of its present structure, and hence the outer course of stone of the first 150 feet was of smaller dimensions than it would have been had it been supposed that the monument would ever have reached its present great altitude. But it is only in about the first 40 feet of the outer course of stone of the old structure that the surface cracks and spalling appear; and it is thought that this state of affairs will gradually continue in the old structure until some repair to the outer course of the first 150 feet of the same shall become necessary. This repair, however, will be a very simple matter, involving only the services of stone masons, a good scaffolding, and the outlay of some money. But it is estimated that it will be probably fifty years yet before any repair will be necessary. The monument is considered a substantial and lasting engineering feat, and one that it will take a great convulsion of the earth to affect.

Artificial Rubies.*

BY GEO. F. KUNZ.

The subject of artificial gems is at the present moment of considerable interest. Early this summer the Syndicate des diaments et pierres precieuses was informed that certain stones which had been sold as rubies from a new locality were suspected to be of artificial origin. They were put upon the market by a Geneva firm; and it was surmised that they were obtained by the fusion of large numbers of small rubies, worth at the most a few dollars per carat, into one fine gem, worth from $1,000 to $2,500 per carat.

Some of these artificial stones were kindly procured by Messrs. Tiffany & Co. I was not, however, permitted to break them for analysis, to observe the cleavage, or to have them cut so as to observe the optical axes more correctly. It is possible, however, to detect the artificial nature of this production with a mere pocket lens, as the whole structure is that peculiar to fused masses. Examination elicited the following facts: The principal distinguishing characteristics between these and the genuine stones is the presence in them of large numbers of spherical bubbles, rarely pear shaped, sometimes containing stringy portions, showing how the bubbles had moved. These bubbles all have rounded ends, and present the same appearance as those seen in glass or in other fused mixtures. They are nearly always in wavy groups or cloudy masses. When examined individually they always seem to be filled with gas or air, and often form part of a cloud, the rest having the waviness of a fused mixture. Some few were observed inclosing inner bubbles, apparently a double cavity, but empty. In natural rubies the cavities are always angular or crystalline in outline, and are usually filled with some liquid, or, if they form part of a "feather," as it is called by the jewelers, they are often arranged with the lines of growth. Hence the difference in appearance between the cavities in the natural gem and those in the fused gem is very great, and can readily be detected by the pocket lens. I have failed to find in any of the artificial stones even a trace of anything like a crystalline or angular cavity. Another distinguishing characteristic is that in many genuine rubies we find a silky structure (called "silk" by the jewelers), which, if examined under the microscope, or under a four-tenths to eight-tenths inch objective, we find to be a series of cuneiform or acicular crystals, often iridescent, and arranged parallel with the hexagonal layers of the crystal. When in sufficient number, these acicular and arrow-shaped crystals produce the asteria or star effect, if the gem is cut *en cabochon* form with the center of the hexagonal prism on the top of the cabochon. I have failed to find any of them in the stones under consideration, or even any of the markings of the hexagonal crystal which can often be seen when a gem is held in a good light, and the light allowed to strike obliquely across the hexagonal prism. Dr. Isaac Lea has suggested† that these acicular crystals are rutile, and interesting facts and illustrations have been published by him.

From my own obervations on many specimens, I believe there is little doubt of the truth of this hypothesis. My explanation is that they were deposited from a solution, either heated or cold, while the corundum was crystallizing, and I doubt very much whether they will ever be found in any substance formed by fusion. The hardness of these stones was found to be about the same as that of the true ruby, 8·8, or a trifle less than 9, the only difference being that the artificial stones were a trifle more brittle. The testing point used was a Siamese green sapphire, and the scratch made by it was a little broader but no deeper than on a true ruby, as is usually the case with a brittle material. After several trials it was faintly scratched with chrysoberyl, which will also slightly mark the true ruby.

The specific gravity of these stones was found to be 3·93 and 3·95. The true ruby ranging from 3·93 to 4·01, it will be seen that the difference is very slight, and due doubtless to the presence of the included bubbles in the artificial stones, which would slightly decrease the density. As a test, this is too delicate for jewelers' use; for if a true ruby were not entirely clean, or a few of the bubbles that sometimes settle on gems in taking specific gravities were allowed to remain undisturbed, it would have about the same specific gravity as one of these artificial stones.

I found on examination by the dichroscope that the ordinary image was cardinal red, and the extraordinary image a salmon red, as in the true ruby of the same color. Under the polariscope, what I believe to be annular rings were observed. With the spectroscope the red ruby line, somewhat similar to that in the true gem, is distinguishable, although perhaps a little nearer the dark end of the spectrum. The color of all the stones examined was good, but not one was so brilliant as a very fine ruby. The cabochons were all duller than fine true stones, though better than poor ones. They did not differ much in color, however, and were evidently made by one exact process or at one time. Their dull appearance is evidently due in part to the bubbles. The optical properties of these stones are such that they are evidently individual or parts of individual crystals, and not agglomerations of crystals or groups fused by heating. In my opinion these artificial rubies were produced by a process similar to that described by Fremy and Feil (*Comptes Rendus*, 1877, p. 1029), by fusing an aluminate of lead in connection with silica in a siliceous crucible, the silica uniting with the lead to form a lead glass and liberating the alumina, which crystallizes out in the form of corundum in hexagonal plates, with a specific gravity of 4·0 to 4·1, and the hardness and color of the natural ruby, the latter being produced by the addition of some chromium salt. By this method rubies were formed, which, like the true gem, were decolorized temporarily by heating.

It is not probable that these stones were formed by Gaudin's method (*Comptes Rendus*, xix., p. 1342), by exposing amorphous alumina to the flame of the oxyhydrogen blowpipe, and thus fusing it to a limpid fluid, which, when cooled, had the hardness of corundum, but only the specific gravity 3·45—much below that of these stones. Nor is it at all likely that they were produced by fusing a large number of natural rubies or corundum of small size, because by this process the specific gravity is lowered to that of Gaudin's product. The same also holds good of quartz, beryl, etc.

The French syndicate referred the matter to M. Friedel, of the Ecole des Mines, Paris, supplying him with samples of the stones for examination. He reported the presence of the round and pear-shaped bubbles, and determined the hardness and specific gravity to be about the same as of the true ruby. On analysis he found them to consist of alumina, with a trace of chromium for the coloring matter. The cleavage was not in all cases distinct, and the rough pieces given to him as examples of the gem in its native state had all been worked, so that nothing could be learned of their crystalline structure. When properly cut according to axes, they showed the annular rings. The extinction by parallel light was not always perfect, which he believed to be due to the presence of the bubbles. He states that he himself has obtained small red globules with these inclusions by fusing alumina by oxyhydrogen light; and, although having no positive evidence, he believes these stones to be artificially obtained by fusion.

On the receipt of M. Friedel's report the syndicate decided that all cabochon or cut stones of this kind shall be sold as *artificial*, and not precious gems. Unless consignments are so marked the sales will be considered fraudulent, and the misdemeanor punishable under the penal code. All sales effected thus far, amounting to some 600,000 or 800,000 francs, shall be canceled, and the money and stones returned to their respective owners.

The action taken by the syndicate has fully settled the position which this production will take among gem dealers, and there is little reason to fear that the ruby will ever lose the place it has occupied for so many centuries.

* Abstract from an article on precious stones, in "Mineral Resources of the U. S.," Department of Interior, U. S. Geological Survey.

† Proc. Philad. Acad. Sc., Feb. 16, 1869, and May, 1876.

The Wax Paper Process.

BY J. EDWARDS GOWER.

In all photographic operations on paper the first care should be the selection of a suitable quality, and for the wax paper process it should be thin, have an even texture, and be free from spots and blemishes of any kind.

Having cut it to the required size, the first operation will be waxing the paper. To do this quickly take, say, ten pieces and float three of them, one at a time, on melted spermaceti, or if that be not at hand, on bleached beeswax. Do not use more heat than is absolutely necessary to melt the wax, or you will run the risk of turning the paper black in places. Float the sheets quickly, and let any excess drop off while the wax is still hot. When cool, lay one unwaxed piece on a sheet of white blotting paper; on the top of this lay a waxed one, and then on that two unwaxed ones, and so on until all are used. Now place another piece of blotting paper on the top, and then well rub both sides with a hot iron until the wax is evenly distributed through all the papers. If any one sheet has a superfluity of wax, it must be ironed separately between blotting paper.

The next operation is iodizing the paper. Make the following solution:

Potassium bromide	15 grs.
" iodide	60 "
Distilled water	5 ozs.

into which place the waxed sheets to soak for say two or even three hours. During that time they should now and again be separated and turned over, to remove air bubbles, etc. After being taken out and dried, they will keep any length of time, and can be sensitized, when required, on the following bath:

Silver nitrate	175 grs.
Glacial acetic acid	2 drs.
Distilled water	5 ozs.

Immerse the sheets one at a time, and when all are in, remove any air bubbles that may have formed, with a strip of glass. Keep the sheets moving during the immersion, in order that the sensitizing may be even. An easy method of doing this is to move the bottom sheet to the top about every minute, using a pair of non-metallic forceps. The time of immersion should be from five to ten minutes. The sensitized sheets must now be taken out, drained, and washed in several changes of water; after which they can be dried by gentle artificial heat, or between blotting paper, and are then ready for use. In a dry place they will keep well, but it is all the better to use them as soon as is convenient after sensitizing. As exposures run now, these papers will be voted awfully slow, and indeed they are almost useless for ordinary work. However, on a bright, still day, a landscape may be managed, and also architectural subjects, but, of course, portraiture is out of the question. There is, however, another use to which they may be put and with more chances of success, and that is printing from negatives by artificial light. To say what exposure will be required for this process is difficult, as density of negative, quality of light, and other things have to be considered. But given a negative of medium density, and holding the printing frame about 6 inches from a gas burner, the time of exposure should be about three or four minutes. When required, the frame may be held further from the source of light and a longer exposure given. This circumstance renders it more easy to practice the various "dodges" which are ofttimes necessary for successful printing. The next operation will be the development, and for this we require—

Saturated solution gallic acid	5 oz.
Acetic acid	2 drs.

Pour as much of the solution as is required into the developing dish, and add a few drops of a weak solution of silver nitrate. Two or three pictures may be developed at the same time, and the amateur must exercise his patience, as they take much longer to "come up" than a gelatine plate does. If the image is very slow in making its appearance, or refuses to appear at all, a few drops more silver solution may be added. The density can be easily judged of on account of the transparency of the waxed paper. When development is completed, the prints must be washed and then fixed in hypo. of the usual strength. After this comes the final washing, which must be thorough. If there has been any loss of transparency, it may be restored by passing the hot iron over the prints. These pictures backed with white paper or mounted on white cardboard possess a soft transparency peculiarly their own, and which is certainly not objectionable. If, however, the paper is only wanted for printing, the waxing may be omitted, and in that case the best writing paper may be used, the glaze of which prevents the image sinking too much into the body of the paper, which would result in a general fall off of quality in the finished picture. When using plain paper, the sheets will only require to be floated, and not immersed in the various solutions, as is necessary when it is waxed.

I think that experiments might be made with this process, with a view to seeing if the color of the prints can be varied by any of the toning baths now in general use, as it gives much more promise of producing permanent results than does albumenized paper. Amateurs may also pass pleasantly some of the long winter evenings by printing from some of their negatives by this process, and I think they will find the results quite presentable.

All the operations from sensitizing to fixing must be carried on by the light of a candle placed behind a screen of yellow or orange paper, which gives plenty of light, pleasant to work with.—*Amateur Photographer.*

Electrified Balsam.

Mr. C. V. Boys has described an interesting experiment he has made with some electrified gums and balsams. If sealing wax or any such sticky material is melted in a cup and put on the conductor of an electrical machine, it throws out threads and fibers which break into beads. The cup containing the gum should be inclined from the operator and the electrical machine before the latter is worked, else both will be covered by an invisible sticky web. Burnt India-rubber also sent out the filament; but Canada balsam appears to show the phenomenon best. When a candle flame is held near a cup throwing out such filaments, they shoot to the flame, and sometimes cover the candle, and sometimes discharge into the flame and turn back into the cup. In a few minutes a large quantity of these sticky threads can be made, and as they break into beads, Mr. Boys points out that this plan can be used to pulverize these substances, which are not easily pulverized in the ordinary way.

Fifty Millions' Worth of Diamonds.

The editor of the *Jewelers' Journal* asked a Maiden Lane dealer the other day to estimate the value of diamonds in New York City. In answer to the inquiry, the dealer answered, more than $50,000,000 worth. He stated further that "there are $15,000,000 to $20,000,000 worth constantly on sale by importers. Two of the largest firms are reputed to keep a stock of $1,500,000 each, and there are eight or nine other dealers with half that quantity, besides all the smaller concerns and the jewelers.

ENGINEERING INVENTIONS.

An elevated railway has been patented by Mr. James M. Hannahs, of Chicago, Ill. Combined with a special construction of transverse arched trusses are longitudinal girders with steps resting on upper and lower angle irons of the trusses, with other novel features, designed to make a light and stable structure, the invention being an improvement on a former patented invention of the same inventor.

A railway rail bender and straightener has been patented by Messrs. Emory M. Woodin and Frank J. Gibbs, of Tyrone, Pa. The invention covers a novel construction and combination of parts, making a simple and powerful device whereby a rail may be quickly and effectively curved, or a curvature in a rail in position on the ties may be taken out and the rail straightened.

AGRICULTURAL INVENTIONS.

A machine for distributing fertilizers has been patented by Mr. James R. McCord, of Jackson, Ga. It is for distributing manures wet or dry, adapted for two rows at the same time, and to be adjusted for rows a greater or less distance apart, and to automatically follow irregular rows.

A cultivator has been patented by Mr. Jacob Shuck, of Blue Springs, Neb. It is applicable either as a corn cultivator or as a flat cultivator for wheat, is designed not to clog, and to automatically adjust itself to the contour of the ground over which it is passing.

A corn shock tyer has been patented by Mr. Uriah B. Watkins, of Barclay, Kansas. It is made with a sharpened pin, a metal stock being fixed to the shank, in connection with a knotted cord tightener, and has other novel features, to facilitate tying shocks of corn or other grain to protect them from storm.

MISCELLANEOUS INVENTIONS.

A soap compound has been patented by Mr. Frederick C. Bauer, of Philadelphia, Pa. The invention consists in combining with finely granulated porous material, such as sawdust, a quantity of soap of any approved manufacture.

An automatic damper has been patented by Mr. William A. J. Beauchamp, of Orange, Texas. By this invention an expansion bar is arranged in connection with a series of levers connected to the damper, whereby the fire may be controlled as desired.

A shirt has been patented by Mr. Jacob Falkenberg, of New York City. It has a front piece stitched by seams between the center of the form piece and its side edges to form two flies, adapted to be folded to form a single, or opened out to form a double breasted front.

A sulky has been patented by Mr. Moses McCormick, of Calverton, Md. The invention relates to trotting sulkies, and provides an improved construction and arrangement of parts whereby the horse may be hitched closer to the driver's seat, and the sulky made lighter, less complicated, and stiffer.

An advertising stand has been patented by Messrs. Moses D. Greengard and Fradelshon Harris, of St. Louis, Mo. The invention covers a peculiar construction and arrangement of parts in a stand for holding goods to be displayed, and provided with an advertising plate.

A mop wringer has been patented by Mr. Henry I. Hotchkiss, of South Ryegate, Vt. It is designed to have a substantial support on and in a pail or tub, to balance the strains incident to wringing the mop, and prevent upsetting of the vessel, while allowing mops to be quickly and easily wrung.

A tag hook or needle has been patented by Mr. Oliver H. Hunter, of Warren, Pa. The invention covers a peculiar construction of needle for attaching a string ticket to the inner fold of a roll of goods, so as to avoid cutting off the ticket before the last yard of the piece is taken.

A salt making apparatus has been patented by Mr. Richard G. Peters, of Manistee, Mich. The invention covers a novel construction designed to utilize the waste heat from the vacuum pans to heat the graiuers, which are of the ordinary type, instead of employing live steam for such purpose.

A sad iron has been patented by Mr. August F. Chable, of Evansville, Ind. It is of that class which rotate or are made reversible, so that different faces or irons may be used with one frame or handle, and is adapted to be evenly and quickly heated by any suitable hydrocarbon, such as naphtha at 74°.

A rubber dental plate has been patented by Mr. Ezra W. Talbott, of Napoleon, Ohio. The invention mainly consists in the use of two plates in manufacturing and finishing rubber dental plates, by a novel method of operation, to economize rubber and save much of the labor now required in their manufacture.

A sweat pad hook has been patented by Mr. Charles J. Gustaveson, of Salt Lake City, Utah Ter. It is attached to the pad so as to be attachable and reversible, and so formed as to embrace the rim of the collar and be tightly held between the rim and the harness, to support the pad and also prevent the hames from slipping forward.

A driving mechanism for elevators has been patented by Mr. Joseph P. Bower, of Des Moines, Iowa. The invention consists of a belt pulley having internal gear teeth meshing into a gear wheel rotated by a train of gear wheels connected with the main driving shaft, a double flanged pulley forming part of the support for the belt pulley.

A head rest for barbers' chairs has been patented by Mr. Charles W. Delaney, of Hammond, Ind. A pivot projects from a circular plate secured to the back of the chair, a slotted head rest bar being held upon the pivot, the bar being turned outwardly to form a shoulder to which is hinged a pillow, which may be turned to different positions.

A transom lifter has been patented by Mr. Albert Langstrom, of Council Bluffs, Iowa. Combined with a transom window is a lifting rod having notches, and sliding in fixed brackets at the side, making a simple and easy means for opening and closing the window, or for locking it in an open, partially open, or closed position.

A hair clipper has been patented by Mr. John Bestgen, of Boston, Mass. It has a fixed comb plate, with cutting knives and a cutter plate, operated through a gear connection by turning a handle, with various novel features, making a device designed not to tire the operator, while being very quick and accurate.

An amalgamator has been patented by Mr. Nathan L. Raber, of Corvallis, Oregon. The construction provides a check valve for preventing the immediate contact of the feeder and the mercury, and the flowing of the latter from the motion of the former, a perforated partition plate for partially breaking up the circulation, with a concentrator at the upper end of the pans and means for oscillating it.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

NEW BOOKS AND PUBLICATIONS.

MINERAL RESOURCES OF THE UNITED STATES. Calendar year 1886. David T. Day, Chief of Division of Mining Statistics and Technology. Washington: Government Printing Office. 1887. Pp. viii, 813.

We welcome the appearance of this interesting volume, that each year gains in character and value. A short summary of statistics of the mineral products of the United States in general opens the body of the work. This is by the editor. After this the various products are treated *seriatim*. Iron, copper, lead, nickel, and the other leading metals, mineral products, and coal, are each written about by leading specialists. Not the least interesting part of the present large volume is the treatise by E. R. L. Gould upon mining law. To this nearly seventy pages are devoted, so that a treatment at once comprehensive and concise is guaranteed. As we so often have occasion to remark in these columns, want of space inevitably prevents us from giving a review, properly speaking, of so extensive a work. It may be correctly said that the book is its own best review, so little does it lend itself to summarizing or abbreviation.

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